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ABSTRACT

Generic skills are those overt and covert behaviors which are fundamental to the performance of many tasks and subtasks carried out in a wide range of occupations and which are basic to both specialized applications and job specific skills. They consist of academic, reasoning, interpersonal and manipulation skills. The generic approach is important to occupational training because it is prescriptive, integrated with basic education, and economical. Generic skills are based upon the premise that every occupation requires a worker to function in relation to data, people, and things, in varying degrees. It is the relationship to data which is the focus of this study. Data has been gathered on 27 occupations in four geographical areas. After its analysis, specifications for the development of data skills training packages have been completed. The training packages consist of (1) a discrete curriculum package for each unit, with objectives, tests, and references, (2) an instructor's manual, (3) an answer book, and (4) individualized learning packages where needed. The packages are expected to be ready for pilot testing in January 1974. (Author/MS)

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GENERIC SKILLS

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GENERIC SKILLS FOR OCCUPATIONAL TRAINING

BY

Arthur De W. Smith

Training Research and Development Station
Department of Manpower and Immigration
Prince Albert, Saskatchewan

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FOREWORD

Vocational educators have been seeking and experimenting with approaches to clustering occupations or occupational skills to effect economies in vocational education and to provide students with skills that will permit them a broader occupational choice.

These objectives are among those addressed by generic skills and it is hoped that the project will be of considerable value in the design of vocational education programs that will not only be generic but also individualized. The Training Research and Development Station has done much in the development of curriculum programs in mathematics, communications, life skills and some occupational courses. The generic skills notion provides a prescription for the development of such basic courses that may be used in training for a wide variety of occupations.

The Training Research and Development Station was established in 1972 to develop new methods of training and counseling adults. This book was published by Saskatchewan NewStart with funds provided it by the Department of Regional Economic Expansion.

D. S. Conger, Director

Training Research and Development Station

A C K N O W L E D G E M E N T S

Many people contributed to the concept and development of this study. D. Stuart Conger, Director of Training Research and Development Station, provided many of the original ideas, and ensured that necessary administrative, financial and human resources were provided on a timely basis. Vernon Mullen, Glen Tippett, Walter J. Kawula and James Williams contributed in many brainstorming and decision-making sessions. Ray Gardener, Principal of the Saskatchewan Institute of Applied Arts and Sciences at Regina, and Walter Houseman, Supervisor of the Vocational Education Division, collaborated by supervising the data collection process in Regina and provided many constructive suggestions. Professor Bikkar Randhawa of the University of Saskatchewan developed and managed the computer analyses.

A special mention must be made to the interviewers, Betty Kidd, Bob Lewis, Harold Mackey, Peter Reis, Denis Rivet, Heddle Sinclair and Peter Wilson. Without the data which they collected under the supervision of Walter J. Kawula this report would still only be a hypothesis. To the several hundred employers who unselfishly contributed the time of their employees is extended our gratitude.

Further reports covering the formulation of the generic skills used in dealing with people and things are planned for publication in 1974.

Arthur De W. Smith

September, 1973

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APPENDICIES

(Note that Appendicies I to 4 are included only in the technical report)

APPENDIX I: OCCUPATIONAL SUMMARIES
APPENDIX 2: OCCUPATIONAL COURSE SUMMARY
APPENDIX 3: OCCUPATIONAL ANALYSES
APPENDIX 4: OCCUPATIONAL PROFILE
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CHAPTER I

INTRODUCTION

A - DEFINITION

Generic skills are those overt and covert behaviors which are fundamental to the performance of many tasks and sub tasks carried out in a wide range of occupations and which are basic to both specialized applications and job specific skills.

Generic skills include many of the concepts and skills generally referred to as academic skills (mathematics, communications, etc.), the reasoning skills required to solve problems, make decisions and in general to be able to handle areas of discretion, the interpersonal skills required to work with other people, and the manipulation skills to be able to perform on or with animate and inanimate objects, using and co-ordinating the body senses and muscles.

Examples of generic skills in each of the four areas mentioned above could include:

1. Academic skills - multiplying whole numbers and reading to determine job requirements.

2. Reasoning skills - scheduling work and diagnosing work problems.

3. Interpersonal skills - giving and receiving rewards and discipline.

4. Manipulation skills - hand/eye co-ordination and using proper body posture for lifting and carrying.

Excluded from generic skills are knowledge and procedural items which are job or employer specific and which may be attained as part of the orientation to a new job.

Generic skills are based on the premise that every occupation requires a worker to function in relation to Data, People, and Things in varying degrees. The three functions[1] are:

---

[1]Canadian Classification and Dictionary of Occupations, 1971, published under the authority of the Minister of Manpower and Immigration by Information Canada.

"1. Data - Information, knowledge, and conceptions related to Data, People and Things, obtained by observation, investigation, interpretation, visualization and mental creation; incapable of being touched. Written data take the form of numbers, words and symbols; other data are ideas, concepts and oral verbalization.

2. People - Human beings; also includes animals dealt with on an individual basis.

3. Things - Inanimate objects as distinguished from human beings; substances or materials; machines, tools, or equipment; products. A thing is tangible and has shape, form, and other physical characteristics."

Every occupation described in the Canadian Classification and Dictionary of Occupations and in the Dictionary of Occupational Titles indicates the degree to which the job requires skill in each of these functions. The levels of each of the three functions have been defined as follows:

DATA	PEOPLE	THINGS
0 Synthesizing	0 Mentoring	0 Setting-Up
1 Co-ordinating	1 Negotiating	1 Precision Working
2 Analyzing	2 Instructing	2 Operating-Controlling
3 Compiling	3 Supervising	3 Driving-Operating
4 Computing	4 Diverting	4 Manipulating-Operating
5 Copying	5 Persuading	5 Tending
6 Comparing	6 Speaking-Signaling	6 Feeding-Offbearing
7 { No Significant	7 Serving	7 Handling
8 { Relationship	8 No Significant Relationship	8 No Significant Relationship

Although this classification system of Data, People and Things functions are considered by some to be too gross in nature to yield useful information, we have been able (at least in the Data and People domains) to use the system as a stimulus to identify precise skills within each of the levels.

B - NEED FOR THE GENERIC SKILLS APPROACH

It is increasingly recognized that the rate of technological change as well as the expansions and contractions of specific labour

markets require both a degree of training and of flexibility possessed by relatively very few workers. The problem lies not in the resistance to change on the part of the labour force, but rather on the nature of the curriculum which trains a person for a specific job rather than for a family of jobs and on the nature of the credentials for employment which fail to recognize, in this age of specialization, that many skills are transferable to a variety of occupations. A second problem with the curriculum (and this applies particularly to adult training programs) is that it prepares people for entry level jobs and provides little assistance for the person who wants to learn to perform, or is promoted to, a more skilled job.

One of the results of the evolution of jobs into increasingly narrowing specializations is the fact that we have tended to forget that many of these specialities had, and have, many common skills. Unfortunately, the curricula and credentials, in attempting to appropriately match these evolutions, have ignored the generic aspects of these occupations and nearly all skills are taught and recognized as being disparate.

There are many reasons why the generic approach could be of major importance to occupational training:

1. It permits the clustering of occupations for purposes of training and therefore such training can be carried out in smaller centers where there may be a demand for only 2 or 3 workers in each of several related occupations.

2. By integrating basic education (DATA) and occupational training (THINGS and PEOPLE) it can prevent over teaching of basic education beyond the level required by a given occupation. On the other hand it can prevent the under teaching of certain mathematics or communication skills required by an occupation.

3. It can provide remedial academic upgrading for those who have the official prerequisites but have forgotten the actual skills or knowledge.

4. It permits students who have gained knowledge outside the educational system to have these skills recognized.

5. It ensures that the basic education is relevant to the occupation.

6. It allows teaching the skills when they are needed in terms of the occupational needs or at the appropriate time in one's career.

7. It allows continuous intake and exit of students.

8. It can provide the basis for the alternative of classroom instruction and work experience.

In particular the generic approach would offer the following advantages:

1. Prerequisites by prescription - at the present time most occupational training demands that the adult student have grade 10 or better as a prerequisite. Our initial investigation using job analysis indicates that many jobs for which occupational training is provided actually need considerably less training in mathematics and notably more training in communications. It is possible to prescribe rather precisely the academic prerequisites for any vocational training. Such an arrangement is perfectly compatible with continuous intake-exit procedures. It should be equally possible to prescribe people and things skills. The prescription method could:

   a. prevent over or under teaching of skills;

   b. permit the recognition of knowledge and skills gained outside the formal educational system;

   c. ensure that Basic Training for Skill Development is relevant to chosen occupations;

   d. provide modular training units for the three areas: data, people and things.

2. Integration of Basic Education and Occupational Training - the present separation of academic and vocational programs results in a number of inefficiencies, including:

   a. loss of knowledge between completion of academic and commencement of occupational training;

   b. waiting lists (or perhaps the reverse in some courses) of people who have completed academic pre-requisites but cannot be enrolled immediately in occupational training;

   c. a belief by many adult students, that the academic concepts are not relevant to their occupational goals.

   The integration of basic education and occupational training may be achieved by: butting the two courses together; by providing a period a day for the basic education component as required; or by complete unification.

3. Economy - the generic method may result in economy of cost through:

   a. removal of artificial barriers to occupational training;

   b. removal of artificial standards for job entry;

   c. prevention of training institutions escalating requirements when faced with an oversupply of applicants for admission;

   d. separation between what can and should be taught in the classroom and through hands-on experience.

C - OBJECTIVES AND EXPECTED OUTCOMES

The objectives of this experimental project in training is to determine the extent to which occupational skills can be analyzed and reduced to:

1. Generic skill groups that can be effectively and efficiently used for classroom training for several job families; and

2. Job specific skills that can be learned on the job.

A number of sub objectives will also be tested, including the following:

1. The extent to which clusters of skills could be more advantageous for skill development than the one occupation - one course method.

2. The appropriateness of (including effectiveness and efficiency) of individualization of occupational skill development.

3. The extent to which the learning of academic concepts can be integrated with occupational skill development.

4. The extent to which training given in educational institutions and by employers can be interchangable and mutually recognized for certification.

5. The extent to which a package of instructional modules (with the necessary diagnostic, prescription and achievement tests) can be developed for use in a variety of programs and courses.

6. The extent to which it would be realistic to foster the development of skills in parallel to and timely with career development (recurrent education).

7. The extent to which CMTP course purchase can be more cost effective through the achievement of these objectives.

8. The extent to which training institutions and the instructional staff will use the method and will apply the concepts to other elements of their instruction.

9. The extent to which adult students will be better motivated and learn needed skills more effectively and efficiently.

The following outcomes or products are expected as a result of these studies:

1. Specifications for the development of individualized training packages to enable students to achieve the specific generic skills needed for chosen occupations.

2. Instructional modules and a users handbook in the three domains of:

   a. dealing with data,
   b. dealing with people,
   c. dealing with things.

3. A methodology and instruments for a new system of skill analysis which will provide data directly usable for curriculum development and which is much easier to administer than the traditional systems of job analysis.

4. A handbook for CMC and other counsellors to assist them in specifying or prescribing behaviors required for a job, assess clients qualifications and prescribe necessary training.

This report covers only the initial pilot study of data skills. As detailed in the succeeding chapters data has been gathered on 27 occupations in four geographical areas, the data has been analyzed and specifications for the development of data skills training packages have been completed. Two curriculum developers have been working on the development of these packages which are expected to be ready for pilot testing by the first of January, 1974.

In addition to the above study and development, considerable work has been done on the people and reasoning skills. Taxonomies of skills in these two areas have been completed and a data collection instrument which integrates data, people and reasoning skills is now being tested.

CHAPTER II

OVERVIEW OF STUDY

A - METHODOLOGY

The following sequential steps were identified for the formulation of generic skills within each of the three functional areas of Data, People and Things:

1. Develop Taxonomy of Skills.
2. Develop Data Collection Instruments.
3. Collect Data on Skill Use.
4. Analyze Data Collected.
5. Prepare Curriculum Development Specifications.
6. Disseminate Information.

Although it was planned to examine the Data, People and Things skills separately and sequentially these three areas are not in fact, independent of each other. Many skills appear to encompass two or more of the three functional areas and necessary integration will be carried out as the study progresses. For example, the skills of communication frequently require both academic or Data skills (read, write, talk and listen) and interpersonal or People skills (verbal gestures, establishing rapport, etc.). Whenever it appears that separation of skills by the three functional areas would be artificial or unrealistic they will be unified and dealt with as a single area.

The planned activities were evolved as a result of a preliminary concept study on the Data skills and they may not be completely appropriate for an examination of the People and Things generic skills. The specifications for these activities were developed as a basis for the timetable (Part B of this chapter). These will be altered as necessary to accommodate the People and Things studies. Brief descriptions of these activities are included in the following paragraphs.

Taxonomy of Skills: *To develop a classification system of possible generic skills identified through analysis and synthesis of educational and training curricula, reports of occupational analysis, the Canadian Classification and Dictionary of Occupations, other relevant literature and staff knowledge of the occupations.*

Skills used at the professional level are not considered except when there is reason to believe that they may also be appropriate in what is

generally considered the vocational levels (trades, aides, technicians, etc.). Although the skills are arranged and classified in approximate hierarchical orders no attempt is made to pre-judge which ones might be needed by specific occupations. The taxonomy is considered and used as a means to an end and not as a direct product of the study. In essence, the taxonomy is used as a stimulus to develop a data collection instrument to ascertain which occupations need and use the identified skills.

Data Collection Instruments: *To develop, pilot test and refine as necessary, an instrument or instruments which, through interviewing or other techniques, can be used to collect data from workers and their immediate supervisors to determine skills which are actually used by each occupation analyzed.*

The instruments are not designed to determine the frequency of skill use by a particular occupational worker nor are they designed to determine the value or importance of the skill. They are simply designed to find out which occupations actually use the skills on the job and of these which skills were actually required on job entry. The instruments are carefully designed to ensure that skills held, but not used on the job, are not included in the analysis. In essence, the purpose of the instruments is to collect data on actual occupational skill requirements and to exclude unnecessary skills which may have been learned in academic or occupational training courses. The secondary purpose of collecting data on job entry skills is to determine prerequisites for entry into the occupation and the skills which can be assumed to be developed through a combination of on-the-job experience and employer training programs. Careful consideration is given to ensure that the instrument does not become too unwieldly to be operationally useful or take up an undue amount of supervisor and worker time. Two techniques are used to simplify the instrument:

1. Certain high level skills which are believed to be used by a few occupations (such as the use of quadratic equations) are obtained in rather gross terms. Once the occupations which use these skills have been identified, finer instruments can be developed to ascertain the particular skills used, and

2. Some judgment is exercised in the belief that a number of enabling or subordinate skills can be identified through the functions carried out by the workers. For example, if it is found that a particular occupation has to read business forms and correspondence for factual content (literal comprehension) the enabling skills can quite easily be inferred.

The instruments are developed to collect the following types of data:

1. The skills which the worker uses on the job.
2. The skills which the worker needed on or for job entry.
3. The skills which the supervisor believes or knows are used on the job by the worker.
4. The skills which the supervisor expected or knew the worker needed on or for job entry.

and where appropriate:

5. The skills which were developed in the occupational training course.
6. The skills which were prerequisite to participation in the occupational training course.

Data Collection: *To collect data on skill use from a variety of occupations encompassing a cross section of employers in urban and rural areas. Employers are selected from a spectrum of large, small, specialized and government employers.*

Occupations are selected using criteria such as:

1. large numbers in the working force;
2. regular Canada Manpower Training Programs (CMTP) course purchase and other training programs;
3. occupations where employees are predominantly male or female;
4. a range of levels from the aide or helper to the technician.

Workers are selected on the basis of the recommendation of the employer's supervisor. The supervisors are asked to name the particular worker who is most representative of the occupation and who could supply the needed data. No attempt is made to select workers on the basis of their seniority or trade level of proficiency.

Data Analysis: *To determine generic skills requirements for each occupation surveyed, the utility of the data collection instruments and processes, occupational and skill clusters, comparisons of skill requirements in different geographical locations, and where appropriate, anamolies between job requirements and the occupational training course data.*

Criteria are developed to establish skill requirements and skill options based on the data collected for each occupation surveyed. Total

responses from all occupations are also examined to determine the relative use of each skill. From these analyses one can produce:

1. Generic skill profiles for each occupation.
2. A matrix of occupations and skills.
3. Clusters of occupational families.
4. Clusters of skills.
5. Correlations of workers' and supervisors' judgments regarding skills.
6. Percentage of responses for each skill.
7. Inconsistencies between instructional and job requirements.

Develop Specifications: *To prepare specifications for the development of prescriptive training modules which will facilitate the achievement of the specific generic skills needed by adults for chosen occupations, allow recognition of skills already held, provide for continuous intake and exit of students and provide means by which adults may acquire additional skills at a time convenient to career advancement.*

Some of the anticipated specifications include:

1. The content, profiles and cluster of skills.
2. The terminal behaviors to be used for diagnosis, prescription and achievement testing.
3. Guidance for the curriculum developers in the selection and development of learning materials and tests to make them occupationally oriented.
4. Guidance for the developers in the methods of assembly and packaging of the instructional modules.
5. Statements of the intended objectives and uses of the training packages by educational institutions and employers.
6. Guidance for the development of appropriate student instruction and credential systems.

Dissemination: *To prepare and deliver oral and written reports covering the rationale and theory, methodology, data collection, analysis of findings, and the development specifications to concerned federal, provincial and educational institution officials.*

Further editions of this report to include the integration of Data, People and Things skills are planned for publication as follows:

1. Generic Data and People skills - January 1974
2. Generic Data, People and Things skills - September 1974

B - THE TIMETABLE

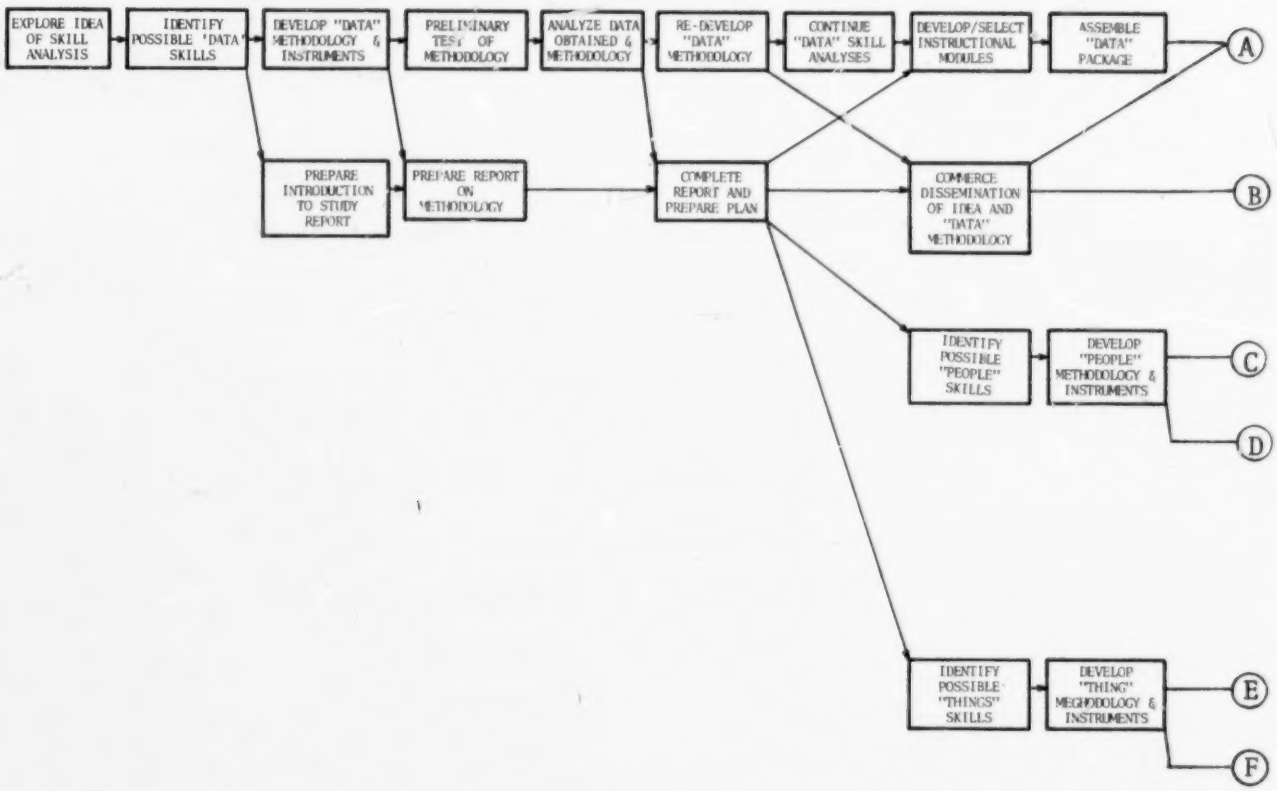
The Plan, which was formulated in February 1973, after some preliminary development and testing of the methodology within the data functions, included the following proposal: to develop and test methodologies for generic skill analysis in the three worker functions in relation to Data, People and Things; to apply these methodologies to occupations which are representative of CMTP purchase and to workers representative of industry; to develop and test training packages for the generic skills identified; to disseminate the developed methodologies to provinces and training institutions; and to do advanced development of the training packages to provide wide application in CMTP and industrial programs and courses. The activities identified and their sequential inter-relationships are shown on a Network Diagram at Annex A to this chapter.

It was, and still is, difficult to forecast the duration of many of the activities involved in this project. However, based on experiences with the data skills, a realistic estimate of the commencement dates for the important activities is shown in Table 1.

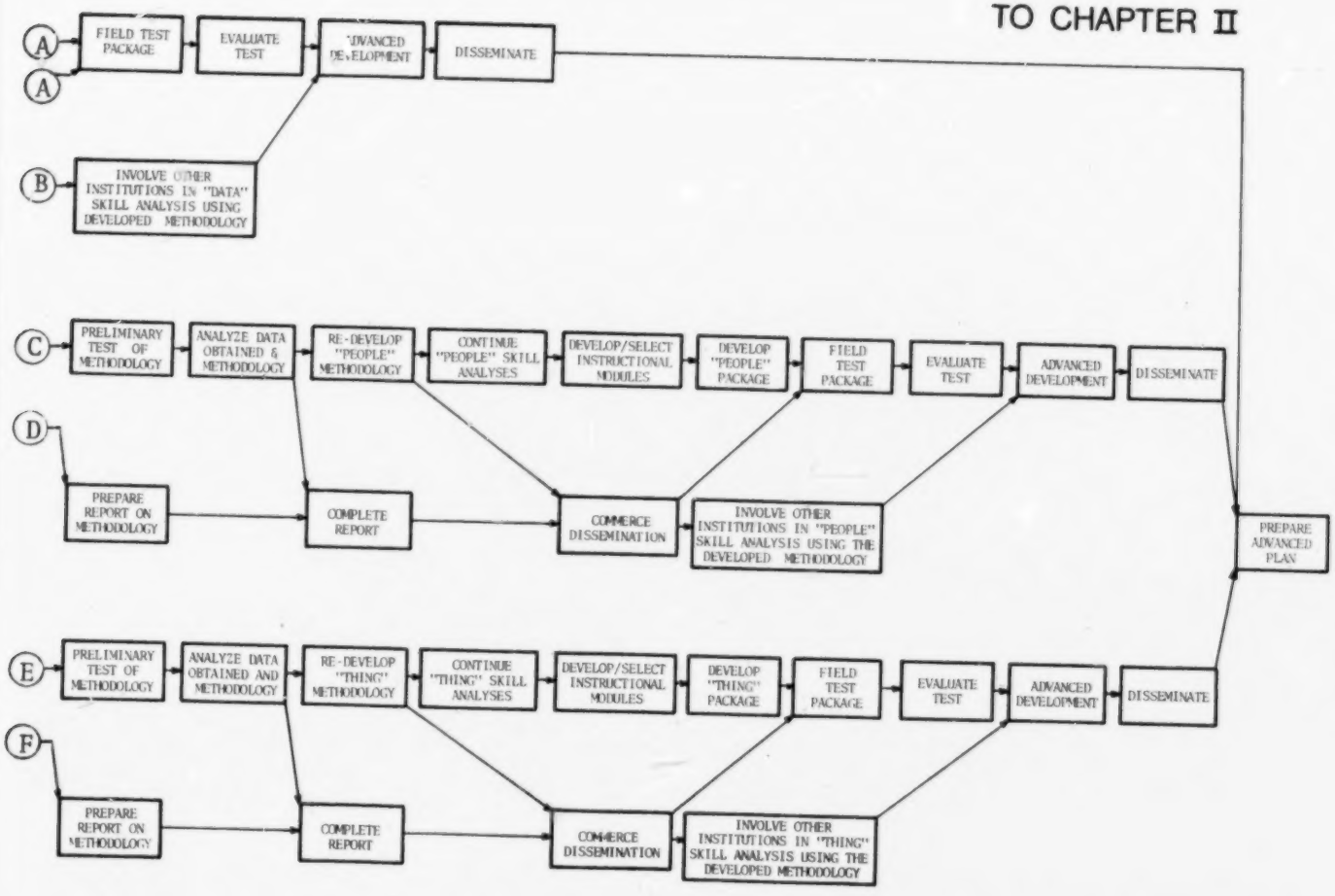
TABLE I: ESTIMATED COMMENCEMENT DATES FOR SELECTED ACTIVITIES

ACTIVITY	COMMENCEMENT DATES		
	DATA	PEOPLE	THINGS
Taxonomy of Skills	February 73	May 73	January 74
Instrument Design & Test	March 73	August 73	March 74
Data Collection	May 73	September 73	May 74
Data Analysis	June 73	November 73	June 74
Development Specification	June 73	November 73	June 74
Publish Report	September 73	March 74	September 74
Curriculum Development	June 73	November 73	June 74
Field Test	October 73	April 74	October 74
Advanced Development	January 74	September 74	January 75

NETWORK DIAGRAM OF ACTIVITIES



ANNEX A
TO CHAPTER II



CHAPTER III

GENERIC DATA SKILLS - PRELIMINARY DEVELOPMENT

A - TAXONOMY OF DATA SKILLS

The first task in the developing of a taxonomy of data skills was to develop a structure or organization to serve as a frame of reference for the identification of job oriented data skills. The levels of Data Functions shown in Appendix C to the Canadian Classification and Dictionary of Occupations (CCDO) were selected as being most suitable for this purpose. These levels are as follows:

Level 0 - Synthesizing
Level 1 - Co-ordinating
Level 2 - Analyzing
Level 3 - Compiling
Level 4 - Computing
Level 5 - Copying
Level 6 - Comparing

The functional descriptions for these levels were re-phrased in behavioral language and considered as terminal skill objectives, as follows:

1. Level 1 - co-ordinate time, plan and sequence of operations or action to be taken on basis of analysis of data and execute determinations or reports.

2. Level 2 - analyze and evaluate data and present alternative action in relation to the data.

3. Level 3 - compile information including gathering, collating or classifying information about Data, People and Things and report and/or carry out prescribed action.

4. Level 4 - compute arithmetic operations and report on or carry out prescribed actions as a result.

5. Level 5 - copy, transcribe, enter or post data.

6. Level 6 - compare widely observable functional, structural or compositional characteristics of Data, People and Things.

Level 0 (synthesizing) was not included because of the previous decision not to include professional occupations in this study. In retrospect, it is now considered possible that some of the skills of synthesizing may be applicable to non-professional occupations and it is therefore planned to analyze and include this level in advanced development.

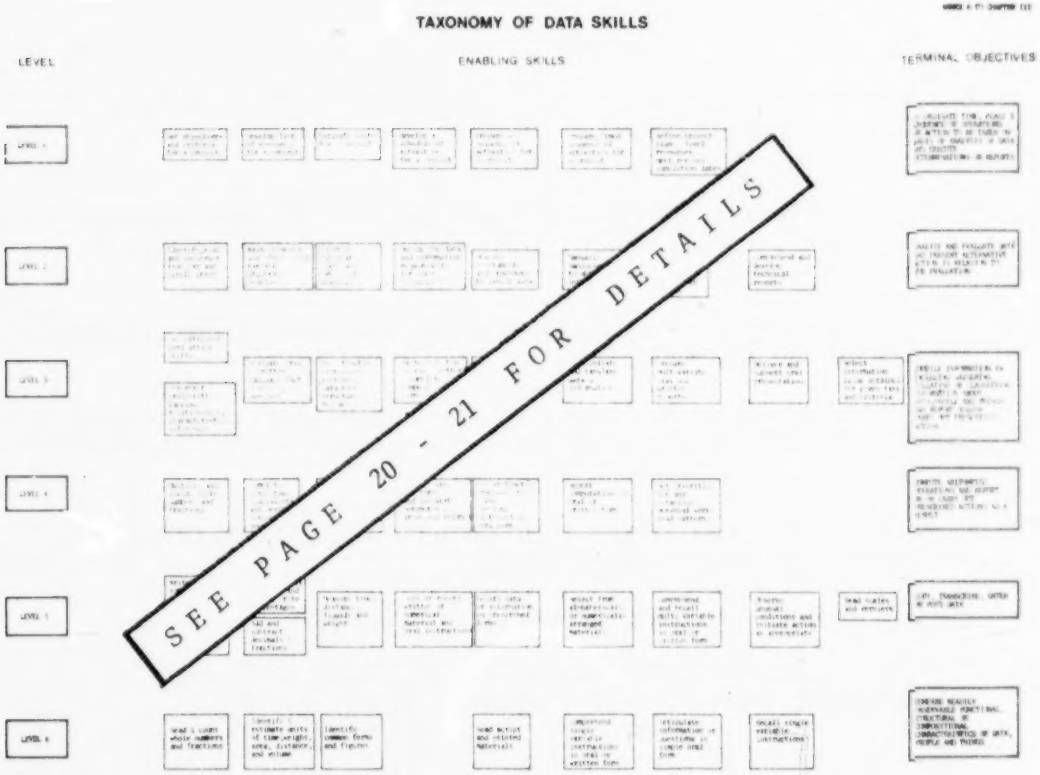
A chart as shown in the diagram at Table 2, was developed in the following manner:

1. The terminal objectives were recorded on cards and affixed to the right side of the chart in a column from Level 1 to Level 6.

2. As skills were identified they were recorded on cards and placed on the chart on a line corresponding to the appropriate level.

3. These skill cards were then arranged in an approximate order of skill development from left to right.

TABLE 2. OVERVIEW OF CHART



Although it was recognized that these functional levels are not precisely hierarchical it was decided to treat them as if each level subsumed skills shown in the lower (high numbered) levels. Thus the identification process was begun at Level 6 and it was not necessary to repeat skills once identified (although similar but more expert skills were identified at successive levels.

A number of other resources were used to identify the possible enabling skills which might be necessary to function at each level. The following were the most significant:

1. A variety of adult education curricula, used by the provinces to achieve adult grade equivalencies, were examined and skills considered appropriate to the functional levels were included in the taxonomy.

2. A number of skills were ascertained by an examination of reports of trade analysis and occupational training curricula.

3. Sample descriptions of duties, at each functional level, were extracted from the CCDO and used, in conjunction with staff familiarity of these occupations, to identify further skill requirements.

The taxonomy of data skills developed is shown on the chart attached at Annex A to this chapter.

It is important to realize that this taxonomy was developed only as a means to an end - the end being the development of an instrument to collect data on skill usage. As a result of the further developments, errors of omission in the taxonomy have been established, such as the use of metric measurement and the reading of Roman numerals. Some of these errors were discovered during the development of the data collection instrument and the skills were added to the instrument at that time. Others were found during the analysis (Chapter V) and the additional skills were included in the revised instrument.

B - DATA COLLECTION INSTRUMENT

As the data collection instrument was developed and refined through exploratory field tests the following criteria were established:

1. To gather information on skills used on the job rather than skills held by the employee.

2. Not to quantify or qualify the information obtained in terms of:

   a. the frequency of skill use, or
   b. the importance of the skill.

3. To gather data on skill use from workers and from their immediate supervisors.

4. To determine skill use on job entry as well as during later job performance.

5. To obtain data for each selected occupation on the generic skills needed to participate in the occupational training course (prerequisites) and those developed while taking the course.

6. To allow the employers to select the occupational worker whom they consider would be best able to supply the necessary data (no attempt was made in this study to obtain data indicative of trade level or seniority - the worker could range from an apprentice to a journeyman).

7. To obtain the data from the workers, their immediate supervisors and from instructors by a structured interview questionnaire.

A copy of the Generic Data Skills Questionnaire which was developed and used to gather the data for this report is included as Annex B to this chapter. The following design specifications helped in the preparation of the format and content of this questionnaire.

1. Skills which were believed to be common to and easily recognizable by the workers were introduced at the beginning of the questionnaire. This action was taken to preclude a negative reaction or the possibility of the workers making the assumption that they should supply some positive answers.

2. Whenever possible questions were based on readily observable behaviors. Mental or covert behaviors were only questioned when it was found impossible to obtain the information by other means.

3. The questions were, as much as possible, based upon the occupational use of the skill and in workmen's terms.

4. Examples, illustrations and diagrams were used when deemed necessary to show the concept or explain the skill.

5. Related skills were carefully sequenced to ensure that the interviewees could quickly and readily respond to the questions.

It was considered particularly important that the instrument be reasonably short and easy to administer to ensure that it had no negative impact effect on the employers or workers. This necessitated a careful consideration of the content and some skills which the reader may consider important, have perhaps not been included. It also necessitated the use of some rather global questions where it was believed that skill use would only be applicable to a small number of the occupations. The form was designed so it could be completed in about an half hour interview.

The questionnaire includes a number of skills which are not normally included in BTSD programs, but which appeared to be common occupational requirements, such as:

1. The ability to estimate various measurements such as time, weight and distance.

2. Various listening, talking and discussing behaviors.

3. Diagnostic behaviors.

4. Behaviors dealing with complexity of job instructions and the setting of work priorities.

Conversely, the questionnaire does not include a number of skills which appear to have an academic rather than a work orientation, such as:

1. Literature comprehension and appreciation.

2. Mathematical concepts which are abstract or rarely used such as number sets, cube root solution, mathematical definitions, angle and triangle nomenclatures.

Skills pertinent to Data Level 1 - (Co-ordinating) were not included in this version of the instrument. These skills are planned for inclusion at a later date so that supervisory occupations can be surveyed.

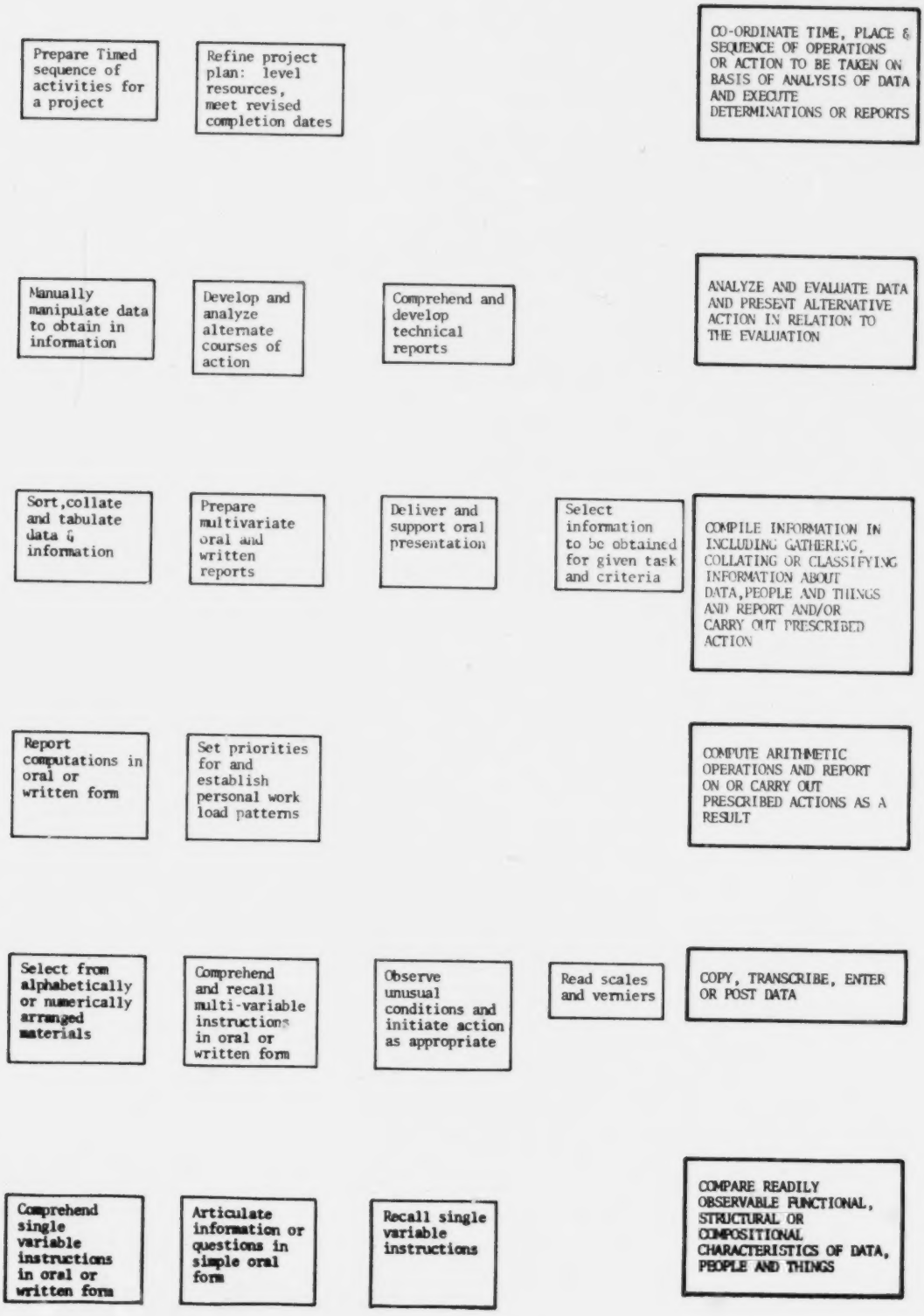
The questions were framed in the context of worker interviews. The interviewer was expected to rephrase the questions as necessary for supervisor and instructor interviews. (See Part C of Chapter IV).

In addition to the collection of data on skill use it was considered essential to obtain academic and vocational employment prerequisites set by employers. This data requirement is included on the last page of the interview questionnaire.

TAXONOMY OF DATA SKILLS

LEVEL	ENABLING SKILLS				
LEVEL 1	Set objectives and criteria for a project	Develop list of resources for a project	Estimate costs for a project	Develop a schedule of activities for a project	Prepare a sequence of activities for a project
LEVEL 2	Identify, read and construct line, bar and circle graphs	Write, simplify and solve single variable algebraic problems	Identify, calculate, scale and make scale drawings	Decide the data and information requirements for given objectives	Develop instruments and procedures to gather data
LEVEL 3	Use efficient word attack skills Interpret oral/written language: relationships, characteristics, inferences	Evaluate oral & written language: facts, opinions, purposes	Use effective expression, sentence, paragraph structure & mechanics	Write effective business letters & complete commonly used forms	Classify multivariate verbal and numerical data
LEVEL 4	Multiply and divide whole numbers and fractions	Complete percentage equivalents and perform percentage operations	Perform ratio and proportion operations	Draw figures and forms and calculate perimeters, areas, and volumes	Use arithmetic processes to solve problems expressed in word form
LEVEL 5	Write and round off whole numbers and fractions Add and subtract whole numbers and fractions	Read, write and round off decimals and read & write percentages Add and subtract decimals & fractions	Measure time, distance, liquids and weight	Copy or record written or numerical material and oral instructions	Record data or information on prescribed forms
LEVEL 6	Read & count whole numbers and fractions	Identify & estimate units of: time, weight, area, distance, and volume	Identify common forms and figures		Read script and printed materials

TERMINAL OBJECTIVES


Prepare Timed sequence of activities for a project
Refine project plan: level resources, meet revised completion dates
CO-ORDINATE TIME, PLACE & SEQUENCE OF OPERATIONS OR ACTION TO BE TAKEN ON BASIS OF ANALYSIS OF DATA AND EXECUTE DETERMINATIONS OR REPORTS
Manually manipulate data to obtain in information
Develop and analyze alternate courses of action
Comprehend and develop technical reports
ANALYZE AND EVALUATE DATA AND PRESENT ALTERNATIVE ACTION IN RELATION TO THE EVALUATION
Sort,collate and tabulate data & information
Prepare multivariate oral and written reports
Deliver and support oral presentation
Select information to be obtained for given task and criteria
COMPILE INFORMATION IN INCLUDING GATHERING, COLLATING OR CLASSIFYING INFORMATION ABOUT DATA,PEOPLE AND THINGS AND REPORT AND/OR CARRY OUT PRESCRIBED ACTION
Report computations in oral or written form
Set priorities for and establish personal work load patterns
COMPUTE ARITHMETIC OPERATIONS AND REPORT ON OR CARRY OUT PRESCRIBED ACTIONS AS A RESULT
Select from alphabetically or numerically arranged materials
Comprehend and recall multi-variable instructions in oral or written form
Observe unusual conditions and initiate action as appropriate
Read scales and verniers
COPY, TRANSCRIBE, ENTER OR POST DATA
Comprehend single variable instructions in oral or written form
Articulate information or questions in simple oral form
Recall single variable instructions
COMPARE READILY OBSERVABLE FUNCTIONAL, STRUCTURAL OR COMPOSITIONAL CHARACTERISTICS OF DATA, PEOPLE AND THINGS

ANNEX B
CHAPTER III

Interviewer _____

GENERIC SKILLS QUESTIONNAIRE

Date of Interview _____

CCDO Occupation _____ No. _____

Address _____ Phone No. _____

Person Interviewed _____

Worker _____ OR

Supervisor _____
(Name and Appointment)

NOTES TO INTERVIEWER

- The purpose of this questionnaire is to determine, by questioning, the generic skills which are performed on the job and those which were required on entry to the job.

- SKILLS HELD BUT NOT USED ON THE JOB ARE NOT TO BE RECORDED.

- The worker and supervisor should not be shown each others responses.

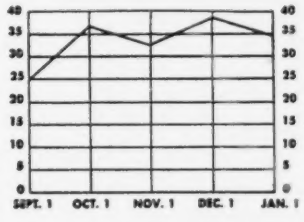
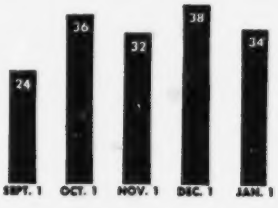
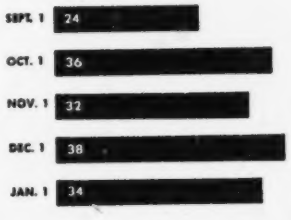
- MAKE NO ASSUMPTIONS - SKILLS USED ON THE JOB ARE FREQUENTLY DIFFERENT FROM WHAT YOU MAY EXPECT.

- If in doubt about a response ask to see an example or for an explanation of the skill used. If the interviewee does not understand a question, rephrase it.

- Specify the specific application of the skill used where you consider it appropriate.

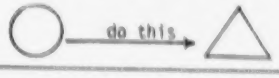
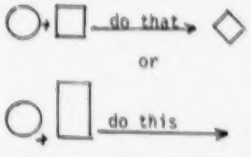
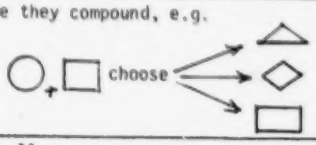
QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
MATHEMATICS			
1. USE OF NUMBERS - In which of the following ways do you use numbers in your work:			
A. Whole Numbers	Read		
	Write		
	Count		
	Add or Subtract		
	Multiply or Divide		
	Round Off		
B. Fractions	Read		
	Write		
	Add or Subtract		
	Multiply or Divide		
C. Decimals	Read		
	Write		
	Add or Subtract		
	Multiply or Divide		
	Round Off		
D. Per Cent	Read		
	Write		
	Calculate With		
E. Equivalents	Change Fractions to Decimals or Percentages		
	Change Decimals or Percentages to Fractions		
	Change Decimals to Percentages or Percentages to Decimals		
F. Solve Problems in Word Forms	In your work do you ever have to do more than one of these calculations at a time and decide the order in which they are done.		
G. Ratio and Proportion	Do you use ratio to show comparisons between two numbers. Example: gas oil mix 16:1, or compression ratio 8:1.		
	Do you use proportion to solve problems like 4:6 = 3:( ). For example 4 gallons of gas requires 40 oz. of oil. How much oil would be needed for 3 gallons. $\frac{4}{40} = \frac{3}{(\ )}$		
H. Areas, Perimeters and Volumes	Does your work involve the calculation of:		
	Areas		
	Perimeters		
	Volumes (specify)		

QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
I. Algebra	Write problems in algebraic form at the one variable level: two plus a number is 5 2 + X = 5		
	Simplify problems written in algebraic form at the one variable level: 3 (2X + 5) = 3 6X + 15 = 3		
	Solve problems algebraically at the one variable level: Solve this problem by first writing a word sentence showing how the facts and unknown are related, then writing an open sentence and then solving the open sentence. Problem: Bill is 7 years older than his sister. If Bill is 21, how old is his sister?		
	Write, simplify and solve two variable algebraic problems		
	Write, simplify and solve quadratic problems		
	Solve problems involving variations		
J. Trigonometry	Use Tables of Logarithms		
	Use a Slide Rule		
	Perform Trigonometric Calculations (specify)		
K. Geometry	In your work do you have to identify (recognize) common forms and figures such as circles, triangles, spheres, rectangles, squares, etc.		
	Do you have to draw sketch or form these figures		
	Do you have to read scale drawings such as blueprints		
	Do you have to take measurements from scale drawings		
	Do you have to draw to scale		

QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
2. MEASUREMENT			
A. In your work do you have to estimate any of the following units of measurement:	Time (e.g. how long it will take to do a job)		
	Weight (how much something probably weighs)		
	Distance (inches, feet, yards, miles)		
	Area (square feet, square yards, etc.)		
	Volume (cubic yards, gallons, bushels etc.)		
B. In your work do you have to actually measure:	Time		
	Weight		
	Distance		
	Quantity		
C. In your work do you use any of the following units of measure:	Kilometre, metre, centimetre		
	Kilogram, gram, milligram		
	Kilolitre, litre, millilitre		
D. In your work do you make use of tables to perform the following conversions:	kilometres, metres, centimetres to miles, yards, inches or reverse		
	kilograms, grams, centigrams to pounds, ounces or reverse		
	litres, millilitres to cubic inches, cubic feet, quarts, gallons, bushels or reverse		
E. In your measurements do you read:	Scales such as postage meters, weigh scales, thermometers, etc.		
F. Do you use verniers such as micrometers			
3. GRAPHS			
			
			
	Does your work involve the use of graphs		
	Do you record information on graphs		
	Do you construct (draw) graphs		

QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
COMMUNICATIONS			
4. READING			
A. In your work do you read:	Notes, letters or memos		
	Forms such as work orders, job orders, vouchers, claims purchase orders		
	Charts (excluding maps, lists and two column tables)		
	Policy manuals, regulations and instructions		
B. In your work reading:	Do you only determine facts		
	Have to determine opinions, purposes or hidden meanings		
	Have to compare a given selection with a previous one		
C. Do you use information from books such as:	Telephone directory Catalogue Dictionary Technical reference Company manual		
Do you ever use more than one book at a time. e.g. - use a number of catalogues to find the cheapest item - locate information in a library			
Do you compare references from two or more books and set a value or judgment on the one to use			
5. WRITING			
A. In your work do you have to:	Write (compose) letters		
	Write (compose) memos		
B. Fill in or complete forms using:	Only short phrases and/or figures		
	Sentences		
	Paragraphs		
C. Prepare reports which:	Show information but no suggestions or recommendations		
	Include recommendations		
D. Prepare reports which require you to:	Decide what information you need to do the job - (You, receive job instructions where you have to decide what information is required to do the job)		
	Decide how to get the information - (You make up your own forms, or charts or procedures to get the information)		
	Analyze the information - (You have to compare information against preset standards to determine which is most important and effective		
	Evaluate the information - (You set the standards for analysis. This may include making lists of advantages and disadvantages of different items)		

QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
6. LISTENING - In your work do you receive oral (word of mouth) information or instructions which requires you to:	Only know the facts or directions		
	Know opinions, purposes or hidden meanings		
7. TALKING Do you talk to people in your work by:	Giving job directions or instructions		
	Giving information		
	Obtaining information by asking questions		
	Giving formal talks		
8. DISCUSSING A. In your work do you:	Debate with your fellow workers or customers to support your point of view, work methods or procedures		
	Debate with your supervisor		
	Take part in formal meetings or conferences which require you to present a point of view		
B. Does your work involve:	Sorting information or objects by a given list. e.g. - sort and file correspondence - sort vouchers by types - sort expenditures or receipts - sort parts or tools		
	Setting up the lists for sorting the information or objects. e. g. - prepare forms to record correspondence, telephone calls, or list of visitors - prepare sub headings or breakdowns for expenditures or receipts - prepare forms to record information you believe others have a need to know - prepare file systems		
9. DIAGNOSING Some workers use what are known as diagnostic skills. They examine symptoms (or faults) to determine the problem which causes the symptom. Doctors use these skills to determine the reasons for our aches and pains. Mechanics also use these skills to determine why a car won't start or doesn't run properly. We are trying to find out whether or not you use diagnostic skills and if so which ones. In your work do you:	Ever have to determine the possible reason why something does not work or why mistakes have been made.		
(If this is a negative answer ignore the remaining questions in 9.)			

A. Do you:	Ever have to list, state or think of possible reasons which might cause certain faults or symptoms		
	Use reference manuals to guide you in selecting the possible reasons		
	Ever have to establish a priority or sequence in which to check the possible reasons		
	Have to personally check to find out which of the possible reasons is the correct one		
	Use reference manuals to guide you in how to check each reason		
B. If you do have to check to find out which of several possible problems is the correct one do you do this by:	Asking probing questions		
	Examining by, smelling, touching, looking at or tasting		
	Using tools or instruments		
C. If you make an error in your diagnosis would it possibly result in:	Loss of life		
	Some danger or hazard		
	Considerable loss of time		
	Some loss of time		
	Considerable financial loss		
	Some financial loss		
10. INSTRUCTIONS			
A. How complicated are the instructions you follow in carrying out your job:	Are they simple, e.g. If this happens  		
	Are they complex, e. g. If this and this happen  		
	Are they compound, e.g.  		
B. In performing your job, how often do you establish your own work priorities:	Usually		
	Sometimes		
	Rarely		
	Never		

FOR SUPERVISORS ONLY	
1. Is there a compulsory academic requirement for entry into this position Grade - specify_____ or Adult Equivalency - specify_____	
2. Are any vocational training courses required for entry into this position - specify_____	

CHAPTER IV

GENERIC DATA SKILLS - DATA GATHERING PROCESS

OVERVIEW

The aim of this chapter is to describe the processes used to gather statistics on the use of Data skills. These will be discussed under the following headings:

1. Selection of Occupations.
2. Selection of Employers.
3. Selection of Interviewers.
4. The Interview Process.

A - SELECTION OF OCCUPATIONS

The following criteria were used to select occupations:

1. Occupations in which worker skills are traditionally developed by Federal or provincial training programs such as the Canada Manpower Training Program (CMTP) and Apprenticeship Programs.

2. Occupations in which there are large numbers of people in the working force.

3. A range of occupations from the aide or helper up to the technician level.

4. A number of occupations from several families, such as, office workers, construction trades, and transportation operators.

5. Occupations where employees are predominantly male or female.

Because the data collection instrument was not designed to measure planning, co-ordinating, sequencing, and other supervisory skills, occupations in which the workers owned or managed their own enterprises were not included in the survey. It was, for example, planned to include Upholsterers but it was found, at least in the province of Saskatchewan, that the majority of upholsterers managed their own businesses and this occupation was therefore deleted, firstly because of the possibility that the data collected would relate to management skills rather than trade skills, and secondly, because the data collection instrument had not been designed to measure supervisory or management skills.

Within the above criteria the actual selection was primarily a matter of judgment. Most of the occupations selected are coded data levels 2 and 3 by the CCDO. Some were selected at the 4, 5, 6 and 8 functional levels so the data collection would be tested in a range of levels.

The occupations from which data was collected are shown in the first column of Table 3.

B - SELECTION OF EMPLOYERS

The following criteria were used in an attempt to obtain an appropriate cross section of workers:

1. Whenever possible, only one worker and his immediate supervisor, were interviewed for any one employer.

2. A total of 10 workers were surveyed in each occupation. These, in turn, were sub-divided as follows:

   a. 2 to 3 workers selected from large employers,
   b. 2 to 3 workers selected from small employers,
   c. 2 to 3 workers selected from specialized employers, and
   d. 2 to 3 workers selected from government employers (federal, provincial and municipal).

   No specific criteria were set to establish the difference between large and small employers but, in general, the larger industries selected usually had five or more workers in the occupational area.

3. The 27 chosen occupations were assigned for survey in a variety of Saskatchewan areas, as follows:

   a. Saskatoon - 12 occupations,
   b. Regina - 9 occupations,
   c. Prince Albert - 9 occupations,
   d. Prince Albert and rural - 3 occupations, and
   e. Rural areas - 1 occupation.

Four of the occupations were assigned to two of the above areas and one occupation to three areas. The assigned areas are shown in the second column of Table 3.

TABLE 3

OCCUPATIONS, LOCATIONS AND INTERVIEWERS

OCCUPATION	LOCATION	INTERVIEWERS
1. Steno, Clerk Typist, Receptionist	Prince Albert	Wally Kawula
2. Steno, Clerk Typist, Receptionist	Regina	Harold Mackey
3. Steno, Clerk Typist, Receptionist	Rural	Heddle Sinclair
4. Secretary	Prince Albert	Wally Kawula
5. Secretary	Regina	Harold Mackey
6. Accounting Clerk	Prince Albert	Wally Kawula
7. Accounting Clerk	Regina	Harold Mackey
8. Motor Vehicle Mechanic	Prince Albert	Wally Kawula
9. Motor Vehicle Mechanic	Regina	Bob Lewis
10. Radio TV Serviceman	Prince Albert & Rural	Heddle Sinclair
11. Radio TV Serviceman	Saskatoon	Peter Reis - Betty Kidd
12. Nurses Aide	Prince Albert & Rural	Heddle Sinclair
13. Nurses Aide	Regina	Harold Mackey
14. Plumber	Regina	Bob Lewis
15. Electrician	Regina	Bob Lewis & Harold Mackey
16. Painter	Saskatoon	Betty Kidd
17. Carpenter	Prince Albert	Heddle Sinclair
18. Welder	Saskatoon	Peter Reis - Betty Kidd
19. Construction Labourer	Saskatoon	Peter Wilson
20. Meat Cutter	Prince Albert	Heddle Sinclair
21. Commercial Cook	Prince Albert	Denis Rivet
22. Driver Single Axle	Saskatoon	Peter Reis - Betty Kidd
23. Heavy Equipment Operator	Saskatoon	Betty Kidd
24. Tractor Trailor Operator	Saskatoon	Betty Kidd
25. Construction Equipment	Saskatoon	Betty Kidd
26. Barber	Saskatoon	Betty Kidd
27. Cosmetologist	Saskatoon	Peter Reis
28. Survey Aide	Regina	Bob Lewis
29. Draftsman	Regina	Bob Lewis
30. Retail Sales Clerk	Saskatoon	Peter Reis
31. Waiter	Prince Albert	Denis Rivet
32. Storeman	Prince Albert	Heddle Sinclair
33. Maintenance Man Building	Saskatoon	Betty Kidd
34. Medical Lab Technician	Prince Albert & Rural	Heddle Sinclair

The Saskatchewan Institute of Applied Arts and Sciences, Regina, collaborated in this study by supervising the interview process in Regina.

Within the above criteria the interviewers were permitted to select the employers whom they believed would adequately represent the occupational workers.

The occupations selected represent approximately 25 per cent of Canada's labour force (excluding technical and professional).

Twenty sets of data were obtained on each occupation (10 workers and 10 supervisors). The sample does not meet usual standards for size in occupational research and certain replication studies are underway. The information gathered, however, does appear to be more detailed and specific than that obtained in any other studies for the purpose of defining occupational skills for curriculum development. It might also be noted that in an exploratory study carried out in Mighigan,[1] they found that, "An unanticipated but significant result of the interviews was finding that skill requirements are so similar from employer to employer that only a small number of firms (usually six to eight) needed to be interviewed to learn the specific skill requirements associated with each occupation".

C - SELECTION OF INTERVIEWERS

The interviewers were expected to be able to: make the arrangements for the interviews with employers with no financial compensation; to use the same interview instrument with a variety of workers and supervisors for a number of occupations; to make arrangements with and obtain data from occupational instructors; and to accurately record the information obtained. They perforce had to:

1. Persuade workers, supervisors and instructors to grant the time for the interviews.

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[1]An Exploratory study to Analyze the Skill Content in Selected Occupations in Michigan and the Mechanisms for its Translation into Vocational Education Curricula, as reported in the article, "Are Vocational Courses Relevant", in Manpower (July 1973).

2. Solicit responses by phrasing questions and statements in a context meaningful to the occupational background and the conversational style of the interviewee.

3. When necessary, rephrase questions until the interviewee understands the information sought in the interview.

4. Rephrase the questions on the interview form when obtaining data from supervisors and instructors.

To satisfy the above requirements the following criteria were used for the selection of interviewers:

1. Sufficient knowledge of the academic concepts to be able to rephrase the questions and apply judgment when interviewers showed examples of or explained how they used the skills.

2. Sufficient general knowledge of the work force to be able to comprehend occupational jargon and establish sound communications with the interviewees.

3. Persuasive and easy to meet - able to make a favourable impression and sufficiently disciplined to obtain accurate data in a time frame which would not disturb the employers.

4. Sufficient and obvious maturity so rapport could be established quickly with supervisors (normally the point of first contact).

5. Willingness to accept ideas on skill usage which might be contrary to personal notions and experience.

The above factors, together with the availability of people who could work full or part-time, influenced the choice of the following as interviewers:

1. Part-time, retired or unemployed vocational instructors.

2. Part-time, retired or unemployed Basic Education instructors.

3. Retired personnel officers who had been involved with a variety of occupations.

In addition to the use of the criteria and the care which was applied in the recruiting program it was found that a structured training program was essential to ensure consistency in the interpretation of the interview items, minimal interviewer bias, and a thorough understanding of the process. The following activities were used to train interviewers:

1. Briefing on the nature and purpose of the project (1 hour).

2. A discussion on the criteria to be used for selecting and conducting the interviews (1 hour).

3. An overview on the content and use of the questionnaire (1 hour).

4. A demonstration interview conducted by the data collection supervisor with both the data collection supervisor and the trainee interviewer recording data on the questionnaire form followed by a comparison of data recordings (1 hour).

5. Practice interviews monitored by the supervisor and followed by necessary evaluation (1 hour each).

D - THE INTERVIEW PROCESS

The interviewers were required to carry out the following tasks:

1. Select employers and arrange interviews with supervisors and workers. In the case of the Regina interviews the selection of employers was approved by the data collection supervisor - a recommended process to help ensure an appropriate selection. Some of the interviewers pre-arranged the interviews by telephone appointments, but the majority found better success by direct contact without an appointment. In only two cases (because of work pressure) were interviews denied but in a few cases, the interview of the worker could not be carried out at the place of work (this was particularly true of occupations such as Heavy Equipment Operators). Normally the initial contact was either with a supervisor or personnel manager.

2. Interview and record data supplied by 10 workers and their immediate supervisors. The interview process averaged about 20 minutes each and the total time required for any employer (including interview and explanation) rarely exceeded one hour.

3. Transcribe data from the questionnaires to summary data forms. This could have been done by an office worker but it was discovered during the original exploratory tests that this led to the possibility of a high degree of error. The interviewers used a variety of short cuts and symbols to record the data which was not consistent between interviewers, and resulted in additional work to ensure clarification. This problem could have been eliminated by introducing a standard system during the interviewer training program.

4. Attend periodic meetings to report on progress achieved, problems encountered, and to make constructive suggestions on the methodology and instrument.

5. Prepare a final written report which summarized these difficulties and recommendations.

In addition, some of the interviewers were required to arrange and conduct interviews with appropriate occupational instructions.

In most cases the supervisor was interviewed first and the supervisor was quick to suggest a worker who was competent in the occupation and would be fluent in the interview. The questions to the supervisor were rephrased similar to the following example:

the question:	In which of the following ways do you use numbers in your work?
became:	In which of the following ways does (name of worker) use numbers in (his,her) work?

It was discovered early in the pilot testing of the questionnaire that the data supplied by the worker and supervisor had to be kept confidential from each other. Once the workers found that the supervisor would not see their responses they became quite objective and showed no unwillingness to respond.

In many cases supervisors and workers, after answering particular questions, gave statements or showed the interviewer examples of the skill usage. In most cases this action reinforced the data supplied. There were, however, some cases, where this necessitated the interviewer having to probe deeper to ensure an accurate response.

To help ensure a high quality of data collection the interviewers were closely supervised and the data collection instruments carefully checked. To ensure a steady stream of feedback the interviewers were allowed to concentrate on no more than four occupations at one time and pressure was put on them to complete and hand in occupational units which had been started. Because of the geographical dispersion of the interviews this was not always successful and some interviewer errors were not discovered at an early stage. The types of errors discovered will be discussed in the next chapter.

The occupational summaries acquired as a result of this process are included as Appendix 1 (to the technical report). A sample page is at Plate I. It will be noted that:

1. An abbreviated version of the questionned skills (from the Generic Data Quesionnaire) is shown on the left column.

2. The affirmative responses from workers and supervisors are shown by check (✓) marks.

3. Letter codes are used to indicate:
   a. W - for worker responses,
   b. S - for supervisor responses,
   c. A - for responses on skills used on the job, and
   d. B - for responses on skills used or needed on job commencement.

OCCUPATIONAL SUMMARY

Stenographer 4111-118
Clerk Typist 4113-124 Prince Albert
Receptionist 4171-118

CHECK (✓) RESPONSES

QUESTIONNAIRE REFERENCE	W-1 A	W-1 B	S-1 A	S-1 B	W-2 A	W-2 B	S-2 A	S-2 B	W-3 A	W-3 B	S-3 A	S-3 B	W-4 A	W-4 B	S-4 A	S-4 B	W-5 A	W-5 B	S-5 A	S-5 B	W-6 A	W-6 B	S-6 A	S-6 B	W-7 A	W-7 B	S-7 A	S-7 B	W-8 A	W-8 B	S-8 A	S-8 B	W-9 A	W-9 B	S-9 A	S-9 B	W-10 A	W-10 B	S-10 A	S-10 B	Total A	Total B	Total A	Total B
Whole Nos: Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10	10	10	10
Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10	10	10	10
Count	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10	10	9	9
Add or Subtract	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8	8	10	10
Multinly or Divide	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓			✓	✓			✓	✓	✓	✓	✓	✓	✓		7	7	8	9
Round Off	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓			✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	7	7	9	9
Fractions: Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓			✓	✓			✓	✓	✓	✓					7	7	5	6
Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓			✓	✓			✓	✓							7	7	5	5
Add or Subtract	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓									✓	✓							✓	✓	✓	✓					5	5	4	4
Multinly or Divide	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓									✓	✓							✓	✓	✓	✓					5	5	4	4
Decimals: Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	10	10	8	8
Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10	10	8	8
Add or Subtract	✓	✓	✓	✓							✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓									✓	✓	✓	✓	✓	✓	✓	✓	6	6	6	6
Multinly or Divide	✓	✓	✓	✓							✓	✓	✓	✓	✓	✓							✓	✓	✓	✓									✓	✓	✓	✓	✓	✓			5	5	5	5
Round Off	✓	✓	✓	✓							✓	✓	✓	✓	✓	✓							✓	✓	✓	✓									✓	✓	✓	✓	✓	✓			5	5	5	5
Per Cent: Read	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓			✓	✓			✓	✓					✓	✓	✓	✓							✓	✓	✓	✓	✓	✓	✓		6	6	7	7
Write	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓			✓	✓			✓	✓					✓	✓	✓	✓							✓	✓	✓	✓	✓	✓	✓	✓	5	5	7	7
Calculate With	✓	✓									✓	✓							✓	✓					✓	✓	✓	✓											✓	✓	✓	✓	3	3	4	4
Equivalents: Frac. to decimal or %	✓	✓	✓	✓							✓	✓													✓	✓	✓	✓															3	3	4	4
Decimal to % or fract	✓	✓	✓	✓							✓	✓													✓	✓	✓	✓															3	3	4	4
Combinations	✓	✓	✓	✓							✓	✓													✓	✓	✓	✓															3	3	4	4
Word Problems	✓	✓			✓	✓															✓	✓					✓	✓															5	4	2	1
Ratio	✓	✓	✓	✓			✓	✓																																	1	1	2	2
Proportion	✓	✓	✓	✓			✓	✓																																	1	1	2	2
Areas			✓	✓																					✓	✓	✓	✓															1	1	2	2
Perimeters			✓	✓																					✓	✓																	1	1	1	1
Volumes			✓	✓																					✓	✓																	1	1	1	1
Algebra: Write																																														
Simplify																																														
Solve																																														
2 Variables																																														
Quadratics																																														
Variations																																														
Trigonometry: Logs																																														
Slide Rule																																														

CODES: W - WORKER
S - SUPERVISOR

A - SKILLS USED ON JOB
B - SKILLS USED COMMENCEMENT OF JOB

PLATE I

SAMPLE PAGE OF OCCUPATIONAL SUMMARIES

4. The total responses from workers and supervisors are recorded in the right column.

In addition to the data from workers and supervisors, information was also obtained from instructors responsible for the occupational training courses. The interviewers rephrased the questions included in the questionnaire to obtain, for each question, the following data:

1. Under the heading "Skills used on the job", an identification of the skills which are developed by the occupational training course.

2. Under the heading, "Skills used on job entry", an identification of the skills which the instructor deemed essential as a prerequisite for student participation in the occupational training course.

A few of the occupations surveyed do not have a corresponding occupational course survey, either because no local training courses are offered or because an instructor interview could not be arranged during the period of the survey.

The occupational course summary acquired as a result of this process is included as Appendix 2 (to the technical report). A sample page is at Plate II. The check marks (✓) indicate those questions which the instructors indicated were skills taught on the course and skills required for course entry.

In general, employers and occupational instructors were enthusiastic and willingly participated in this study. A surprising number asked the interviewers to give them feedback on the responses received for the occupation being surveyed. To help preserve this co-operation and as a gesture of appreciation for their assistance, thank you letters, including a summary of the occupational data for the particular occupation were forwarded to the participating employers. An example of the letter and summary is at Annex A to this chapter.

PLATE II

SAMPLE PAGE OF OCCUPATIONAL COURSE SUMMARY

		PA	R	RU	PA	R	PA	R	PA	R	PA & RU	PA & RU	R	R	PA
		1. Steno, Clerk Typist Receptionist	2. Steno, Clerk Typist Receptionist	3. Steno, Clerk Typist Receptionist	4. Secretary	5. Secretary	6. Accounting Clerk	7. Accounting Clerk	8. Motor Vehicle Mechanic	9. Motor Vehicle Mechanic	10. Radio, T.V. Service	11. Nurses Aide	12. Nurses Aide	13. Plumber	14. Carpenter
SER	QUESTIONNAIRE REFERENCE	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B
1	Whole Nos: Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Count	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Add or Subtract	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	Multiply or Divide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	Round Off	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	Fractions: Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	Add or Subtract	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	Multiply or Divide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	Decimals: Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12	Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
13	Add or Subtract	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14	Multiply or Divide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15	Round Off	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
16	Per Cent: Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17	Write	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
18	Calculate With	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19	Equivalents: Frac. to decimal or %	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
20	Decimal to % or fract.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
21	Combinations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
22	Word Problems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
23	Ratio							✓	✓	✓	✓	✓	✓	✓	✓
24	Proportion							✓	✓	✓	✓	✓	✓	✓	✓
25	Areas							✓	✓	✓	✓	✓	✓	✓	✓
26	Perimeters							✓	✓	✓	✓	✓	✓	✓	✓
27	Volumes							✓	✓	✓	✓	✓	✓	✓	✓
28	Algebra: Write		✓					✓	✓	✓	✓	✓	✓	✓	✓
29	Simplify		✓					✓	✓	✓	✓	✓	✓	✓	✓
30	Solve														
31	2 Variables														
32	Quadratics														
33	Variations														
34	Trigonometry: Logs										✓			✓	
35	Slide Rule										✓			✓	
36	Calculations														✓
37	Geometry: Identify Forms					✓		✓	✓	✓	✓	✓			✓
38	Sketch							✓							

CODES: A - SKILLS TAUGHT IN COURSE
B - SKILLS REQUIRED FOR COURSE ENTRY

PA - PRINCE ALBERT
RU - RURAL

S - SASKATOON
R - REGINA

Your file Votre référence

Manpower and Immigration / Main-d'œuvre et Immigration

Our file Notre référence

Training Research and Development Station

ANNEX A OF CHAPTER IV

FOLLOWUP TO EMPLOYERS

During the past few months we have been conducting a study of academic skills components in occupational training. An important part of this study is a series of interviews conducted with workers, supervisors and instructors.

We are finding the process of interviewing workers, supervisors and instructors in various occupational areas to be very effective in determining academic skills used. Your participation in these interviews has been most helpful and indeed greatly appreciated. As work proceeds on this study we look forward to your continued cooperation.

As a follow-up to these interviews we are enclosing a copy of the interview instrument containing a summary of data collected for a particular occupation. The information from your interviews is included in this summary.

Thank you for your cooperation and please convey our thanks to:

Yours truly,

Wally Kawula
Industrial Programs

154-8th Street, East, P.O. Box 1565, Prince Albert, Saskatchewan, Canada

ANNEX A OF CHAPTER IV

NOTE: This interview instrument contains a summary of the number of positive responses from 10 workers and their corresponding supervisors in the following occupation: Carpenter (Construction)

The following table illustrates the way the data has been compiled:

QUESTIONS	SKILL USED	
	ON JOB	ON JOB ENTRY
COMMUNICATIONS		
4. READING		
A. In your work do you read: Notes, letters or memos	8-9	7-7

This table reads: 8 workers reported that they read notes, letters or memos in their work.

9 supervisors reported that they expect their workers to read notes, letters or memos in their work.

7 workers and 7 supervisors reported that these skills are required on job entry.

In each and every case the 1st number represents workers and the 2nd represents supervisors.

ANNEX A OF CHAPTER IV

Interviewer J. H. Sinclair

GENERIC SKILLS QUESTIONNAIRE

Date of Interview _____

CCDO Occupation CARPENTER (CONSTRUCTION) No. _____

Address _____ Phone No. _____

Person Interviewed _____

Worker _____ OR

Supervisor _____
(Name and Appointment)

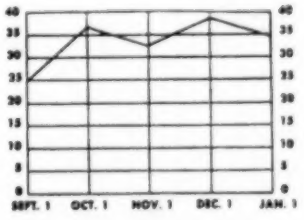
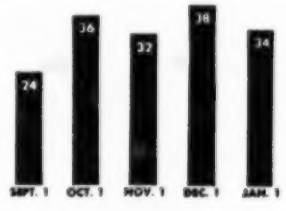
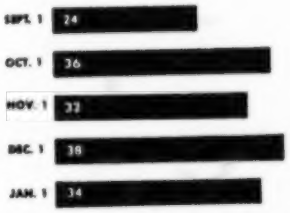
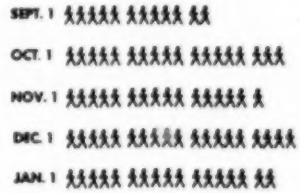
NOTES TO INTERVIEWER

- The purpose of this questionnaire is to determine, by questioning, the generic skills which are performed on the job and those which were required on entry to the job.
- SKILLS HELD BUT NOT USED ON THE JOB ARE NOT TO BE RECORDED.
- The worker and supervisor should not be shown each others responses.
- MAKE NO ASSUMPTIONS - SKILLS USED ON THE JOB ARE FREQUENTLY DIFFERENT FROM WHAT YOU MAY EXPECT.
- If in doubt about a response ask to see an example or for an explanation of the skill used. If the interviewee does not understand a question, rephrase it.
- Specify the specific application of the skill used where you consider it appropriate.

QUESTIONS		SKILL USED ON JOB	SKILL USED ON JOB ENTRY
MATHEMATICS			
1. USE OF NUMBERS - In which of the following ways do you use numbers in your work:			
A. Whole Numbers	Read	10-10	10-10
	Write	10-10	10-10
	Count	10-10	10-10
	Add or Subtract	10-10	10-10
	Multiply or Divide	10-10	10-10
	Round Off	10-9	10-9
B. Fractions	Read	10-10	9-10
	Write	10-10	10-10
	Add or Subtract	10-10	9-10
	Multiply or Divide	10-10	9-10
C. Decimals	Read	9-8	8-7
	Write	9-8	8-7
	Add or Subtract	8-8	8-7
	Multiply or Divide	8-8	8-7
	Round Off	8-8	8-7
D. Per Cent	Read	4-4	4-3
	Write	4-4	4-3
	Calculate With	4-4	4-3
E. Equivalents	Change Fractions to Decimals or Percentages	4-4	4-3
	Change Decimals or Percentages to Fractions	4-4	4-3
	Change Decimals to Percentages or Percentages to Decimals	4-3	4-3
F. Solve Problems in Word Forms	In your work do you ever have to do more than one of these calculations at a time and decide the order in which they are done.	3-3	2-2
G. Ratio and Proportion	Do you use ratio to show comparisons between two numbers. Example: gas oil mix 16:1, or compression ratio 8:1.	6-8	3-3
	Do you use proportion to solve problems like 4:6 = 3:( ). For example 4 gallons of gas requires 40 oz. of oil. How much oil would be needed for 3 gallons. $\frac{4}{40} = \frac{3}{(\ )}$	5-3	3-0
H. Areas, Perimeters and Volumes	Does your work involve the calculation of: Areas	10-7	10-6
	Perimeters	10-9	10-9
	Volumes (specify)	10-7	9-6

QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
I. Algebra	Write problems in algebraic form at the one variable level: two plus a number is 5 2 + X = 5	2-2	1-1
	Simplify problems written in algebraic form at the one variable level: 3 (2X + 5) = 3 6X + 15 = 3	0-0	0-0
	Solve problems algebraically at the one variable level: Solve this problem by first writing a word sentence showing how the facts and unknown are related, then writing an open sentence and then solving the open sentence. Problem: Bill is 7 years older than his sister. If Bill is 21, how old is his sister?	0-0	0-0
	Write, simplify and solve two variable algebraic problems	0-0	0-0
	Write, simplify and solve quadratic problems	0-0	0-0
	Solve problems involving variations	0-0	0-0
J. Trigonometry	Use Tables of Logarithms	0-0	0-0
	Use a Slide Rule	3-2	1-1
	Perform Trigonometric Calculations (specify)	0-0	0-0
K. Geometry	In your work do you have to identify (recognize) common forms and figures such as circles, triangles, spheres, rectangles, squares, etc.	10-10	10-9
	Do you have to draw sketch or form these figures	8-7	7-4
	Do you have to read scale drawings such as blueprints	10-10	3-6
	Do you have to take measurements from scale drawings	10-10	3-5
	Do you have to draw to scale	5-5	2-1

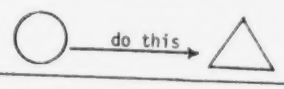
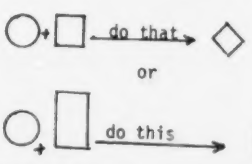
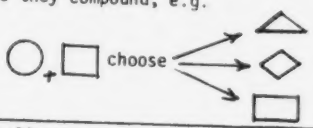
ANNEX A OF CHAPTER IV

QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
2. MEASUREMENT			
A. In your work do you have to estimate any of the following units of measurement:	Time (e.g. how long it will take to do a job)	6-5	1-3
	Weight (how much something probably weighs)	4-3	2-2
	Distance (inches, feet, yards, miles)	8-9	7-8
	Area (square feet, square yards, etc.)	9-9	6-8
	Volume (cubic yards, gallons, bushels etc.)	7-7	6-7
B. In your work do you have to actually measure:	Time	6-8	4-8
	Weight	3-2	3-2
	Distance	9-9	9-9
	Quantity	9-9	8-9
C. In your work do you use any of the following units of measure:	Kilometre, metre, centimetre	0-0	0-0
	Kilogram, gram, milligram	0-0	0-0
	Kilolitre, litre, millilitre	0-0	0-0
D. In your work do you make use of tables to perform the following conversions:	kilometres metres centimetres to miles yards inches or reverse	0-0	0-0
	kilograms grams centigrams to pounds ounces or reverse	0-0	0-0
	litres millilitres to cubic inches cubic feet quarts gallons bushels or reverse	0-0	0-0
E. In your measurements do you read:	Scales such as postage meters, weigh scales, thermometers, etc.	0-0	0-0
F. Do you use verniers such as micrometers		0-0	0-0
3. GRAPHS			
			
			
			
			
	Does your work involve the use of graphs	0-0	0-0
	Do you record information on graphs	0-0	0-0
	Do you construct (draw) graphs	0-0	0-0

QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
COMMUNICATIONS			
4. READING			
A. In your work do you read:	Notes, letters or memos	8-7	7-7
	Forms such as work orders, job orders, vouchers, claims purchase orders	9-7	2-2
	Charts (excluding maps, lists and two column tables)	3-2	1-1
	Policy manuals, regulations and instructions	7-5	1-1
B. In your work reading:	Do you only determine facts	9-8	8-8
	Have to determine opinions, purposes or hidden meanings	3-3	0-1
	Have to compare a given selection with a previous one	3-5	0-3
C. Do you use information from books such as:	Telephone directory Catalogue Dictionary Technical reference Company manual	8-8	6-8
Do you ever use more than one book at a time. e.g. - use a number of catalogues to find the cheapest item - locate information in a library		4-3	3-1
Do you compare references from two or more books and set a value or judgment on the one to use		2-2	0-0
5. WRITING			
A. In your work do you have to:	Write (compose) letters	2-1	0-1
	Write (compose) memos	5-4	3-3
B. Fill in or complete forms using:	Only short phrases and/or figures	5-2	5-2
	Sentences	4-3	4-3
	Paragraphs	4-2	4-2
C. Prepare reports which:	Show information but no suggestions or recommendations	2-2	0-2
	Include recommendations	1-1	0-1
D. Prepare reports which require you to:	Decide what information you need to do the job - (You, receive job instructions where you have to decide what information is required to do the job)	0-1	0-0
	Decide how to get the information - (You make up your own forms, or charts or procedures to get the information)	1-1	0-0
	Analyze the information - (You have to compare information against preset standards to determine which is most important and effective	1-1	0-0
	Evaluate the information - (You set the standards for analysis. This may include making lists of advantages and disadvantages of different items)	1-1	0-0

ANNEX A OF CHAPTER IV

QUESTIONS		SKILL USED	
		ON JOB	ON JOB ENTRY
6. LISTENING - In your work do you receive oral (word of mouth) information or instructions which requires you to:			
	Only know the facts or directions	10-10	10-10
	Know opinions, purposes or hidden meanings	7-8	0-5
7. TALKING Do you talk to people in your work by:	Giving job directions or instructions	10-6	0-2
	Giving information	9-7	0-2
	Obtaining information by asking questions	10-10	6-10
	Giving formal talks	0-0	0-0
8. DISCUSSING			
A. In your work do you:	Debate with your fellow workers or customers to support your point of view, work methods or procedures	8-9	1-3
	Debate with your supervisor	10-9	0-0
	Take part in formal meetings or conferences which require you to present a point of view	0-1	0-0
B. Does your work involve:	Sorting information or objects by a given list. e.g. - sort and file correspondence - sort vouchers by types - sort expenditures or receipts - sort parts or tools	6-7	0-0
	Setting up the lists for sorting the information or objects. e. g. - prepare forms to record correspondence, telephone calls, or list of visitors - prepare sub headings or breakdowns for expenditures or receipts - prepare forms to record information you believe others have a need to know - prepare file systems	3-1	0-0
9. DIAGNOSING Some workers use what are known as diagnostic skills. They examine symptoms (or faults) to determine the problem which causes the symptom. Doctors use these skills to determine the reasons for our aches and pains. Mechanics also use these skills to determine why a car won't start or doesn't run properly. We are trying to find out whether or not you use diagnostic skills and if so which ones.			
In your work do you:	Ever have to determine the possible reason why something does not work or why mistakes have been made.	7-5	1-1
(If this is a negative answer ignore the remaining questions in 9.)			

A. Do you:	Ever have to list, state or think of possible reasons which might cause certain faults or symptoms	7-4	1-1
	Use reference manuals to guide you in selecting the possible reasons	4-2	0-0
	Ever have to establish a priority or sequence in which to check the possible reasons	3-3	1-1
	Have to personally check to find out which of the possible reasons is the correct one	5-4	2-2
	Use reference manuals to guide you in how to check each reason	4-2	1-1
B. If you do have to check to find out which of several possible problems is the correct one do you do this by:	Asking probing questions	6-3	3-3
	Examining by, smelling, touching, looking at or tasting	7-5	7-4
	Using tools or instruments	7-4	4-3
C. If you make an error in your diagnosis would it possibly result in:	Loss of life	3-1	2-1
	Some danger or hazard	3-2	2-1
	Considerable loss of time	5-2	4-2
	Some loss of time	5-3	4-3
	Considerable financial loss	4-2	3-2
	Some financial loss	5-3	4-3
10. INSTRUCTIONS			
A. How complicated are the instructions you follow in carrying out your job:	Are they simple, e.g. If this happens  	10-10	10-10
	Are they complex, e. g. If this and this happen  	10-10	0-0
	Are they compound, e.g.  	8-5	0-0
B. In performing your job, how often do you establish your own work priorities:	Usually	5-2	5-2
	Sometimes	3-4	3-4
	Rarely	2-3	2-3
	Never	0-0	1-1

ANNEX A OF CHAPTER IV

FOR SUPERVISORS ONLY	
1. Is there a compulsory academic requirement for entry into this position	
Grade - specify_____	
or	
Adult Equivalency - specify_____	
2. Are any vocational training courses required for entry into this position	
- specify_____	

CHAPTER V

GENERIC DATA SKILLS - THE ANALYSIS PROCESS

OVERVIEW

The aim of this chapter is to describe the processes used to analyze the data obtained on the use of Data skills and the results of the analyses. These will be discussed under the following headings:

1. Occupational Analyses.
2. Total Response Analysis.
3. Skill Content Analysis.
4. Occupational Matrix and Skill Profiles.
5. Process and Interviewer Errors.
6. Computer Programs.

Because of our objective to develop and field test instructional packages for the Data Skills by the Fall of 1973 it was deemed necessary to carry out the initial analyses, while the data was being collected, by manual procedures. Subsequent analyses were carried out with the assistance of computer programs to ensure accuracy, rectify response errors and to obtain higher level information. Both the manual and computer analyses will be discussed in the succeeding parts of this chapter.

A - OCCUPATIONAL ANALYSES

It will be recalled that the following data on skill use were obtained from ten worker and ten supervisor interviews:

1. Those skills which the workers stated that they used on the job.

2. Those skills which the workers stated that they needed on job commencement.

3. Those skills which the supervisors stated that the worker used on the job.

4. Those skills which the supervisor stated that the worker needed on job commencement.

In addition, for most occupations, the following data were obtained from the instructor responsible for the occupational training course:

1. Those skills which the instructor deemed essential or prerequisite for students to participate in the occupational training course.

2. Those skills which the instructor identified as being developed for students who attend the occupational training course.

The total responses from workers and supervisors for each occupation and the instructor responses are included in the occupational analyses at Appendix 3 (to the technical report). An extract from one page of these analyses is shown at Plate III.

It will be noted that:

1. The questions, from the data collection instrument, are shown in abbreviated form under the heading, "Questionnaire Reference".

2. The total responses from the workers and supervisors are shown under two headings:

   a. A - the number which indicated that they use each skill on the job, and,
   b. B - the number which indicated that they used each skill on job commencement.

3. The data from the instructor is indicated by a check mark (✓) denoting the skills which are prerequisite to the occupational training course (ENTRY) and the skills which the students learn on the course (EXIT).

For most skills, the data collected for each occupation appears to clearly indicate whether or not the skill is used or needed. In a few cases the evidence is not that clear. In examining the data for the separate occupations to determine the occupational profiles, there were a number of points to consider, such as:

1. What should be done when the evidence suggests that the skill is normally developed on the job, either through experience or employer training programs (we obtained no data to suggest <u>how</u> the skills were developed on the job)?

2. What should be done in those (fortunately few) cases where the worker and supervisor data is markedly different? Which data is most significant, the supervisor's (who have hiring and controlling responsibilites) or the worker's (who presumably have more direct knowledge of skills used)?

PLATE III: SAMPLE RESPONSES FOR AN OCCUPATION FROM WORKERS, SUPERVISORS AND INSTRUCTORS.
Occupation: Welder
CCDO Code: 8353-126
Sample size: 10

SER	QUESTIONNAIRE REFERENCE	RESPONSES					
		WORKERS		SUPERVISORS		INSTRUCTORS	
		A	B	A	B	ENTRY	EXIT
1	Whole Nos: Read	10	10	10	10	✓	
2	Write	10	10	10	10	✓	
3	Count	10	10	10	10	✓	
4	Add or Subtract	10	10	10	10	✓	
5	Multiply or Divide	7	7	7	7	✓	
6	Round Off	9	9	9	9	✓	
7	Fractions: Read	7	7	6	6	✓	
8	Write	7	7	6	6	✓	
9	Add or Subtract	7	7	6	6	✓	
10	Multiply or Divide	7	7	6	6	✓	
11	Decimals: Read	7	7	5	5	✓	
12	Write	7	7	5	5	✓	
13	Add or Subtract	6	6	5	5	✓	
14	Multiply or Divide	6	6	5	5	✓	
15	Round Off	7	7	5	5	✓	
16	Per Cent: Read	6	6	7	7	✓	
17	Write	6	6	6	6	✓	
18	Calculate With	6	6	6	6	✓	
19	Equivalents: Frac. to decimal or %	5	5	5	5	✓	
20	Decimal to % or fract.	4	4	5	5	✓	
21	Combinations	4	4	5	5	✓	
22	Word Problems	6	6	5	5		✓
23	Ratio	6	5	6	5		
24	Proportion	3	2	4	3		
25	Areas	7	7	5	5	✓	
26	Perimeters	7	7	7	7	✓	
27	Volumes	7	7	5	5		✓
28	Algebra: Write	0	0	0	0	✓	
29	Simplify	0	0	0	0	✓	
30	Solve	0	0	0	0	✓	
31	2 Variables	0	0	0	0	✓	
32	Quadratics	0	0	0	0		
33	Variations	0	0	0	0		
34	Trigonometry: Logs	0	0	0	0		
35	Slide Rule	2	1	0	0		
36	Calculations	0	0	0	0		
37	Geometry: Identify Forms	6	6	7	6	✓	
38	Sketch	6	6	7	6	✓	

CODES: A - SKILLS USED ON JOB
B - SKILLS USED COMMENCEMENT OF JOB

3. What should be done when one or two of the workers need the skill and the others do not? Which is preferable: (1) training to ensure that all workers for a particular occupation receive training in all potential skill use; (2) elimination of infrequently recorded skill use on the basis of possible response error; (3) elimination of infrequently recorded skill use on the basis of the skill use being job specific (the first clerk typist surveyed showed a high requirement for mathematics because her supervisor developed mathematics programs and had her check his work); or (4) to treat some of the skills as an optional requirement?

4. What should be done when the skill prerequisites or development in occupational training courses were at odds with the data on skill usage?

It appeared obvious that a degree of subjective judgment had to be used to analyze this data, and that the criteria should be consistently applied throughout the analysis. Not all readers will necessarily agree with the judgments exercised - this is the reason we chose to include the raw data in the technical copy of this report as well as the results of our analyses.

To assist in developing criteria to be used in analyzing the data, the types of responses were first graded by what was considered to be their relative importance. These were identified as follows:

1. Worker and supervisor agreement on job entry skills appeared to be the most important type of information. When a significant number of workers and supervisors agreed that a skill is needed to obtain or commence a job this suggested that the skill should be developed in pre-employment programs.

2. The supervisors responses on job entry skills were considered as the next degree of importance - not necessarily because the supervisors' responses were more accurate but for the pragmatic reason that the supervisor usually has an input in the hiring process.

3. The workers responses on job entry skills were assigned the next degree of importance.

4. Worker and supervisor agreement on skills used on the job.

5. Worker responses on skills used on the job.

6. Supervisor responses on skills used on the job were rated as being the lowest level of importance.

Because of the small sample for each occupation surveyed (N = 10) it was necessary to use multiples of ten percent in establishing the criteria. Also because of the small sample it was decided to opt for inclusion rather than exclusion of skills. The criteria used to decide whether a skill would be included are shown in Table 4.

TABLE 4. Criteria used to determine whether there were sufficient responses from workers and supervisors (collectively or independently) to warrant including the skill in an occupation.

Responses	Inclusion Criteria
a. Agreement on job entry	20%
b. Supervisor-job entry	30%
c. Worker-job entry	40%
d. Agreement skills used	50%
e. Worker-skills used	60%
f. Supervisor-skills used	70%

Any one of the criteria shown in TABLE 4 was considered sufficient for skill inclusion. TABLE 5 gives an indication of how the criteria was applied for various types of responses.

TABLE 5. Application of Criteria (TABLE 4) to various types of responses from workers and supervisors.

Responses				Decision	
Worker		Supervisor		Include	Exclude
Job	Job Entry	Job	Job Entry		
4	2	3	2	✓	
4	2	3	1		✓
4	2	3	3	✓	
4	4	3	1	✓	
5	0	5	0	✓	
4	1	4	1		✓
6	2	4	1	✓	
5	1	7	1	✓	

For a few skills in some occupations this still appeared to leave an element of doubt. To help alleviate the problem it was decided to show optional skills where the data was insufficient for inclusion (based on the criteria shown in TABLE 4) but where either the workers or supervisors had supplied significant responses. The criteria used to decide whether a skill would be treated as optional are shown in TABLE 6.

TABLE 6. Criteria used to determine whether there were sufficient responses from workers or supervisors to warrant including the skill as optional in an occupational profile.

Response	Optional Criteria
a. Supervisor job entry	20%
b. Worker job entry	30%
c. Worker skills used	50%
d. Supervisor skills used	60%

Any of the criteria shown in TABLE 6 was considered sufficient for inclusion as an option skill. TABLE 7 gives an indication of how this criteria was applied for various types of responses.

TABLE 7. Application of criteria (TABLE 6) to various types of responses from workers and supervisors.

Responses				Decision	
Worker		Supervisor		Include	Exclude
Job	Job Entry	Job	Job Entry		
0	0	2	1		✓
0	0	2	2	○	
3	2	0	0		✓
3	3	0	0	○	
4	0	0	0		✓
5	0	0	0	○	
0	0	5	0		✓
0	0	6	0	○	

Insufficient time and resources were available to examine in depth, the implications of the instructor versus worker and supervisor responses. It appears, from the evidence, that some instructors are requiring or developing skills which are not used by the workers in performing their jobs. These types of anamolies are evident:

1. In some cases the instructors are demanding skill prerequisites (for participation in the occupational training course) which are not needed for job performance.

2. In some cases the instructors are teaching skills which are not used on the job.

3. Many of the skills used on the job are not included as either a prerequisite to, or as part of, the occupational curricula.

A sample page from the Occupational Analyses (Appendix 3 to the Technical Report) is at Plate IV. An examination of this plate will show that the analysis forms were developed in the following manner:

1. Under the heading, "Questionnaire Reference", is shown an abbreviated description of the questions asked on the Generic Skills Questionnaire.

2. Under the heading, "Responses", are shown:
   a. for workers the total responses from the data at Appendix 1 (to the technical reports),
   b. for supervisors the total responses from the data at Appendix 1 (to the technical report),
   c. for instructors the affirmative responses from Appendix 2 (to the technical report).

3. Under the heading "Decision", using the criteria previously described:
   a. check marks (✓) indicate whether the skill is to be included or excluded,
   b. (0) under the "Include" heading indicates that skill development is considered optional.
   c. check marks in the "Further Analysis" column indicate that an excluded skill is prerequisite to the occupational training course.

The "skill conversion" heading will be discussed in Part C of this chapter.

In addition to the occupational analyses it was deemed essential to compare the skill requirements where the data had been obtained for an occupation or occupational group from two or more geographical areas. It will be recalled (TABLE 3 in Chapter IV) that the following occupations were surveyed in more than one area:

1.	Receptionists Clerk Typists Stenographers	Prince Albert, Regina and Rural (towns, hamlets and villages with populations under 5,000)
2.	Secretaries	Prince Albert and Regina
3.	Accounting Clerks	Prince Albert and Regina
4.	Motor Vehicle Mechanics	Prince Albert and Regina
5.	Radio Servicemen and TV Servicemen	Prince Albert Area and Saskatoon
6.	Nurses Aides	Prince Albert Area and Regina

PLATE IV: SAMPLE PAGE FROM OCCUPATIONAL ANALYSIS

OCCUPATION: Stenographer
Clerk Typist
(Rural Prince Albert)

4111-118
CCDO NO. 4113-124

SAMPLE SIZE: 10

SER	QUESTIONNAIRE REFERENCE		RESPONSES						DECISION			SKILL CONVERSION
			WORKERS		SUPERVISORS		INSTRUCTORS		INCLUDE	EXCLUDE	FURTHER ANALYSIS	
			A	B	A	B	ENTRY	EXIT				
39		Read Scale Drawings	0	0	0	0				✓		9C
40		Measure Scale Drawings	0	0	0	0		✓		✓		9D
41		Draw to Scale	0	0	0	0				✓		9E
42	Estimate:	Time	5	0	6	1			✓			6A
43		Weight	1	0	2	1				✓		6B
44		Distance	0	0	1	0				✓		6C
45		Area	0	0	1	0				✓		6D
46		Volume	0	0	1	0				✓		6E or 6F
47	Measure:	Time	8	8	6	6			✓			7B
48		Weight	8	8	9	9			✓			7C, 7A
49		Distance	1	1	2	2			0			7D, 7A
50		Quantity	10	10	9	9			✓			7E, 7A
51	Metric:	Distance	0	0	0	0				✓		8B, 7A
52		Weight	0	0	0	0				✓		8A, 7A
53		Volume/Quantity	0	0	0	0				✓		8C, 7A
54	Convert:	Distance	0	0	0	0				✓		8E
55		Weight	0	0	0	0				✓		8D
56		Volume/Quantity	0	0	0	0				✓		8F
57	Scales		9	8	7	7		✓	✓			7A
58	Verniers		0	0	0	0				✓		7F
59	Graphs:	Read	1	0	2	1	✓			✓	✓	10D
60		Record	1	0	2	1				✓		10E
61		Draw	1	0	2	1				✓		10E
62	Read:	Notes, letters, memos	10	10	10	10	✓		✓			16A, 15A
63		Forms	10	7	9	6	✓		✓			16B, 15A
64		Charts	3	1	5	0		✓		✓		16C
65		Manuals	10	0	9	0	✓		✓			16D, 15A, 15B
66		Determine Facts	9	9	9	9	✓		✓			15A
67		Determine Opinions	4	0	4	1	✓			✓	✓	15B
68		Comparison	9	8	10	7			✓			15C
69		Books	10	9	10	9	✓		✓			15D
70		Compare Books	8	0	8	1	✓		✓			15E
71		Evaluate References	8	0	8	1	✓		✓			15F
72	Write:	Letters	8	8	9	8			✓			17C, 17F
73		Memos	9	9	10	9			✓			17C, 17E
74	Forms:	Phrases	10	10	10	10		✓	✓			17A, 17D
75		Sentences	9	9	10	10		✓	✓			17B, 17D
76		Paragraphs	8	8	10	10		✓	✓			17C, 17D

CODES: A - SKILLS USED ON JOB
B - SKILLS USED COMMENCEMENT OF JOB

✓ - YES
0 - OPTIONAL

The skill requirements identified for different areas were not always identical. Some of the causes for the differences might be attributed as follows:

1. Real and actual differences in requirements. It is possible, for example, that workers in smaller areas might be expected to need more skills and those in large urban areas might have more specialized duties. This possibility, at least in part, does appear to be suggested by the data.

2. Interviewer bias. The data, in at least one occupation, (Nurses Aide - Prince Albert), does appear to have some bias caused by faulty interviewing techniques as is discussed in Part E of this chapter.

3. The size of the samples or the sampling techniques.

A number of methods could have been used in the comparison of the different geographical areas. The data could have been grouped and the criteria used on this larger sample to determine the skills for inclusion and for optional treatment. We could simply have included all skills identified for the occupation. We chose at this time to include all common skill requirements and to show those which were not common to all areas as an optional requirement. Thus we have identified two types of optional skills.

1. Those considered optional by the criteria previously discussed.

2. Those considered optional due to differences in data from different geographical areas.

The occupational summaries combining occupations surveyed in two or more geographical areas are included in Appendix 3 (to the technical report).

PART B - TOTAL RESPONSES ANALYSIS

The Occupational Analyses by themselves do not give any indication of the universal need for the skills examined in this study. To give the developers an indication of the use of the various skills and to provide an initial cursory examination of the possible reliability of the data gathering instrument, all responses were totalled and percentages of responses to the possible responses calculated. The totals and percentages are shown at Annex A to this chapter.

The following observations appeared to be substantiated by this information:

1. In general, the unanimity between workers and supervisors is noteable - in fact, the agreement is higher than was expected. There are, however, some skills where there are obvious differences in workers/supervisors perception and these items were given particular consideration to determine whether the instrument should be revised to achieve further clarity.

2. Some skills do not appear to have as common an application to job requirements as could be inferred from BTSD programs. Examples are as follows:
   a. solve problems algebraically at the one variable level - 7%
   b. construct graphs - 7%.

3. Elementary arithmetic and communication skills including many listening, talking and discussing skills are common requirements.

4. Many skill items, which are not common to BTSD and other basic education programs, do appear to be significant requirements. Examples are as follows:
   a. estimate measurements - 30% to 58%
   b. listen for facts - 95%
   c. ask questions - 81%
   d. debate with fellow workers, customers or supervisor to support own point of view, work methods or procedures - 68%
   e. diagnose faults (determine reasons why something does not work or why mistakes have been made) - 52%

C - SKILL CONTENT ANALYSIS

Based on the results of the occupational analysis a skill content chart (Plate V) was developed to show the scope and content of the Generic Data Skills identified and analyzed. This chart has the following characteristics:

1. 21 skill areas are identified by a short descriptive name in the column headed, "Unit" on the left of the chart.

2. From three to six items are identified by an abbreviated title for each unit. Thus any item can be located by a combination of the Unit Number and Item Letter. For example, 1C - multiply whole numbers.

PLATE V: CONTENT CHART

UNIT	ITEM A	ITEM B	ITEM C	ITEM D	ITEM E	ITEM F
1. WHOLE NUMBERS	Read, Write & Count	Add and Subtract	Multiply	Divide	Word Problems	Round Off
2. FRACTIONS	Read & Write	Add and Subtract	Multiply	Divide	Word Problems	
3. DECIMALS	Read & Write	Add and Subtract	Multiply & Divide	Word Problems	Round Off	
4. PERCENT	Read & Write	Calculate	Ratio	Proportion	Word Problems	
5. MIXED OPERATIONS	Equivalents	Order of Operations	Occupation Word Problems	Quick Calculations		
6. ESTIMATE MEASURES	Time	Weight	Distance	Area	Liquid Volume	Spatial Volume
7. MEASURE	Scales	Time	Weight	Distance	Quantity	Verniers
8. METRIC MEASURE	Weight	Distance	Quantity	Weight Conversion	Distance Conversion	Quantity Conversion
9. DIMENSIONS	Forms & Figures	Draw/Sketch	Read Scale Drawings	Measure Scale Drawings	Draw to Scale	
10. DIMENSIONS	Perimeter	Area	Volume	Read Graphs	Construct Graphs	
11. ALGEBRA	One Variable	Two Variables	Quadratics	Variations		
12. TRIG	Logs	Slide Rule	Calculation			
13. LISTEN	Literal Comprehension	Interpretive Comprehension	Evaluative Comprehension			
14. TALK	Directions/ Instructions	Information	Questions	Formal Talks		
15. READ	Literal Comprehension	Interpretive & Evaluative	Comparative Evaluation #1	Books	Comparative Evaluation #2	Comparative Evaluation #3
16. BUSINESS READ	Notes, Letters & Memos	Forms	Charts	Manuals		
17. WRITE	Phrases	Sentences	Paragraphs	Forms	Memos	Letters
18. WRITE REPORTS	Information Reports	Recommendation Reports	Sort	Classify	Technical Reports	
19. EXCHANGE IDEAS	Debate	Peer Debate	Supervisor Debate	Conferences		
20. DIAGNOSE	List Causes	Look Up Causes	Set Priorities	Look Up Methods	Probing Questions	Use Senses
21. LATITUDE	Simple Instructions	Complex Instructions	Compound Instructions	Set Priorities		

3. The chart is not intended to display a sequence of development for the identified skills. In fact, many of the items will necessarily have to be developed as discrete behaviors. For example, some workers who have to carry out volume calculations (10C) do not have to also perform perimeter and area calculations (10A and 10B).

4. The items are not intended to represent behaviors of similar magnitude. 11C - Quadratics, is obviously a much more complex set of skills than 3E - Round Off Decimals. The sub-divisions of skills represented on the chart are representative of the different skill requirements identified by the data collection and analysis, rather than of the value or importance of the skills. In other words the chart only shows the scope and content of the 102 skill areas analyzed.

The instructional objectives developed for these items are included in Appendix 5.

Most of the questions asked in the Generic Skills Questionnaire were of the nature that a requirement for a skill (as indicated by the occupational analyses) could be directly indicated on the Skill Content Chart, on a one to one relationship. If, for example, the interviewers indicated that the workers had to add or subtract whole numbers, then it was obvious that they needed skill 1B on the chart.

However, in many cases a questionnaire response indicated a need for two or more skill requirements or a combination of responses indicated an additional skill requirement. For example:

1. A response to any of the skills of measurement indicated a need for the particular item 7B, 7C, 7D, 8A, 8B, or 8C as well as the ability to read scales - skill 7A.

2. A combination of responses such as add, subtract, multiply and divide whole numbers indicated a need to be able to perform problems written in word form (1E).

In one case the questionnaire was worded to include two quite different skills - the estimate of volume which could be either liquid (gallons, quarts, etc.) or spatial (cubic inches, etc.). Judgment and staff knowledge of the occupations had to be used to determine whether affirmative responses indicated a need for skill 6E or 6F (or both).

Some skills were included, such as Quick Calculations (5D), without a data base. Occupations which indicated a need for the elementary manipulative functions with whole numbers, fractions and decimals were also, as a matter of judgment, denoted as needing these additional skills.

Some of the identified skills may not be considered generic because of the infrequency of responses obtained in the data collection phase. Some consideration was given to the removal of items such as 11B, 11C, 11D, 14D and 18E. However, because there has been an indication that additional data collection will be carried out by some provinces and institutions, it was decided not to omit any skill areas until more conclusive evidence is obtained.

The skill conversion is shown in the right hand column of the Occupational Analyses at Appendix 3 (to the Technical Report). See Plate IV.

D - OCCUPATIONAL MATRIX AND PROFILES

Occupational profiles were developed and are included in Appendix 4 (to the technical report - an example is at Plate VI). These profiles were constructed in the following manner:

1. A blank skill content chart (see Plate V) was endorsed with the name of the occupation and the CCDO code.

2. Skills recorded for inclusion in the appropriate Occupational Analysis (Plate IV) were checked (✓) using the skill conversion column to note the particular items.

3. Skills recorded as optional in the Occupational Analysis were marked (O) in the appropriate items on the profile.

Only one profile was prepared for each of those occupations for which data was collected in more than one geographical area.

A matrix of occupations and skills was prepared in a similar manner. This matrix (which is included as Annex B to this chapter) displays the occupations examined on the vertical dimension and the skills identified on the horizontal dimension. The matrix includes the information from each of the occupations surveyed in two or more areas as well as the combined requirements.

PLATE VI: SAMPLE OCCUPATIONAL PROFILE

OCCUPATION: PAINTER CCDO NO. 8785-110

UNIT	ITEM A	ITEM B	ITEM C	ITEM D	ITEM E	ITEM F
1. WHOLE NUMBERS	Read, Write & Count ✓	Add and Subtract ✓	Multiply ✓	Divide ✓	Word Problems ✓	Round Off ✓
2. FRACTIONS	Read & Write ✓	Add and Subtract ✓	Multiply ✓	Divide ✓	Word Problems ✓	
3. DECIMALS	Read & Write ✓	Add and Subtract ✓	Multiply & Divide ✓	Word Problems ✓	Round Off ✓	
4. PERCENT	Read & Write ✓	Calculate ✓	Ratio ✓	Proportion ✓	Word Problems ✓	
5. MIXED OPERATIONS	Equivalents o	Order of Operations ✓	Occupation Word Problems ✓	Quick Calculations ✓		
6. ESTIMATE MEASURES	Time ✓	Weight ✓	Distance ✓	Area ✓	Liquid Volume ✓	Spatial Volume
7. MEASURE	Scales ✓	Time ✓	Weight o	Distance ✓	Quantity ✓	Verniers
8. METRIC MEASURE	Weight	Distance	Quantity	Weight Conversion	Distance Conversion	Quantity Conversion
9. DIMENSIONS	Forms & Figures ✓	Draw/Sketch ✓	Read Scale Drawings ✓	Measure/Scale Drawings ✓	Draw to Scale	
10. DIMENSIONS	Perimeter ✓	Area ✓	Volume ✓	Read Graphs	Construct Graphs	
11. ALGEBRA	One Variable	Two Variables	Quadratics	Variations		
12. TRIG	Logs	Slide Rule	Calculation			
13. LISTEN	Literal Comprehension ✓	Interpretive Comprehension ✓	Evaluative Comprehension ✓			
14. TALK	Directions/ Instructions ✓	Information ✓	Questions ✓	Formal Talks		
15. READ	Literal Comprehension ✓	Interpretive & Evaluative ✓	Comparative Evaluation #1 ✓	Books ✓	Comparative Evaluation #2 ✓	Comparative Evaluation #3 ✓
16. BUSINESS READ	Notes, Letters & Memos ✓	Forms ✓	Charts ✓	Manuals ✓		
17. WRITE	Phrases ✓	Sentences ✓	Paragraphs ✓	Forms ✓	Memos ✓	Letters ✓
18. WRITE REPORTS	Information Reports ✓	Recommendation Reports ✓	Sort ✓	Classify ✓	Technical Reports	
19. EXCHANGE IDEAS	Debate ✓	Peer Debate ✓	Supervisor Debate ✓	Conferences ✓		
20. DIAGNOSE	List Causes ✓	Look Up Causes ✓	Set Priorities ✓	Look Up Methods ✓	Probing Questions ✓	Use Senses ✓
21. LATITUDE	Simple Instructions ✓	Complex Instructions ✓	Compound Instructions ✓	Set Priorities ✓		

codes: ✓ required
o optional

E - PROCESS AND INTERVIEWER ERRORS

As might be expected in a pilot study, errors of both omission and commission were made. Some of these have been identified and are discussed in the following paragraphs.

Generic Data Questionnaire (Annex B to Chapter III). A number of items could have been worded to achieve additional clarity of information. Typical errors discovered are as follows:

1. 1.D. Per Cent. The specific type of percentage calculation is unclear.

2. 1.J. Trigonometry. The third question probably should have identified separately three common types of drawings: blueprints, schematic and assembly.

3. 2.A. Volume. Separate questions should have been asked on fluid measurement and spatial volume.

4. 5.A Write (Compose) Letters. It was erroneously assumed that letters would be descriptive of external communication and memos of internal communications. It was also incorrectly assumed that only a few occupations composed external letters. Further questions on the types of letters would have been of considerable help in analyzing the data.

5. 10.A. Instructions. The symbols used did not truly display the various degrees of complexity of instructions.

6. 10.B. Priorities. The question, as stated, could have meant priorities between job, between tasks or between sub-tasks and the evidence is therefore inconclusive.

7. 5.B and 6. The word, "only" in the questions can be interpreted in two different ways.

8. In general, the questions in the mathematical areas were clearer than those in the communications and reasoning areas. This is probably descriptive of the state of the art in these different areas.

The questionnaire has been revised as a result of the identified errors. The revised version is attached as Annex C to this chapter. It will be noted that the original serial numbers have been used in the revised instrument and additional questions identified by a letter prefix.

This action was taken so that data from both instruments can be handled by the computer programs.

Data Collection Process. A few interviewer errors and mistakes were discovered. Some of these possibly reflected inadequacies in the recruiting and training process. Typical of these errors are the following:

1. In a few cases some of the data were incorrectly totalled in the occupation summaries. Some of these errors were discovered and rectified during data collection - the remainder have been rectified by a computer program.

2. Some interviewers failed to recognize and respond to obvious hierarchies in the Generic Skills Questionnaire. For example, (in 9C), responses at the more serious levels did not always have a corresponding response at the less serious level. This has been rectified by a computer program.

3. In one case it appeared that the interviewer asked a general question for the elementary use of numbers (e.g. do you read, write, count, add or subtract, multiply or divide, and round off whole numbers) instead of asking independent questions. The data from the Nurses Aides in Prince Albert is, for the above probable reason, significantly different than that for the same occupation in Regina.

4. At least one interviewer construed the question (5.A. In your work do you have to write (compose) memos) to include any and all short notes such as, "Call Mr. Jones at 764-2008". This error was corrected during the occupational analysis.

5. Not all interviewers double checked the responses to related skills to determine possible erroneous responses. For example, the carpenters gave high responses to the four measurement skills (time, weight, distance and quantity) and no responses to the skill of reading scales. This error was rectified during the analysis.

We have no evidence to suspect that the interviewers may have biased the data by the methods in which they used to solicit their responses. Careful consideration was given to this possibility in the recruiting and training process and, by and large, it is believed that the majority of the data collected accurately represent the samples of occupational workers.

F - COMPUTER PROGRAMS

Interviewer errors in totalling the Occupational Summaries, of failure to recognize hierarchies and of failure to double check responses to related skills were rectified by the computer programs. The errors in totalling were handled automatically by using the raw data from each interview rather than the totals. The other errors were corrected by a special program as indicated by Table 8. The numbers in Table 8 represent the 115 questions on the Generic Skills Questionnaire (Annex B to Chapter III).

TABLE 8. Computer program to correct response errors

Item checked by interviewer	Computer check item
24	23
40	24
41	24
48	57
49	57
50	57
51	57
52	57
53	56
62	66
63	66
65	66 and 67
69	66
70	66
71	66 and 67

TABLE 8 continued .....

103	104
105	106
107	108
110	109
111	110 and 109
If not checked	Check item
112	115
113	115
114	115

As a result of this correcting program the following changes to skill requirements were identified:

1. Add skills
   a. 7A Read Scales - to waiter
   b. 4D Proportions - to heavy equipment operator
      - to carpenter
   c. 17E Write Memos - to carpenter

2. Delete skills
   5A Equivalents - from cosmetologist

3. Make skill optional
   18C Sorting - to driver single axle

A computer program also identified a few errors made in the manual analyses. These resulted in the following changes to skill requirements:

1. Add skills
   a. 10B Areas - to construction labourer
   b. 7B Time - to cosmetologist

2. Make skills optional
   a. 15C Comparative Evaluation #1 - to driver single axle
   b. 18A Information Reports - to cosmetologist

The Occupational Profiles and Occupational Matrix (Part D of this chapter) were printed before the above changes were ascertained by the computer programs and these skills are therefore not correctly identified in Annex B or in Appendix 4 to the technical report.

To help determine the reliability of the items in the Generic Skills Questionnaire correlations of workers and supervisors responses were determined by a standard Chi - square formula, using the variable 3.841. Levels of significance for each of the 115 items on the questionnaire were computed as shown in Table 9. An analysis of these levels had not been carried out at the time of writing this report but a superficial inspection of the Chi - square levels do appear to indicate that the majority of the items in the questionnaire are significantly reliable.

TABLE 9. Chi-square and PHI levels of significance

ITEM	Chi-Square	PHI	ITEM	Chi-Square	PHI
1	0.0000	0.00451	15	0.0	0.55411
2	0.0233	0.00799	16	0.0	0.43534
3	0.1897	0.01220	17	0.0	0.45382
4	0.0000	0.39825	18	0.0	0.42758
5	0.0	0.49158	19	0.0	0.48518
6	0.0	0.42516	20	0.0	0.52009
7	0.0	0.55104	21	0.0	0.51663
8	0.0	0.56681	22	0.0000	0.38446
9	0.0	0.53704	23	0.0	0.49455
10	0.0	0.60192	24	0.0	0.48262
11	0.0	0.49997	25	0.0	0.46279
12	0.0	0.51015	26	0.0	0.50872
13	0.0	0.53089	27	0.0	0.45970
14	0.0	0.54931	28	0.0	0.53482

TABLE 9 continued .....

29	0.0	0.57921	53	0.0	0.50757
30	0.0	0.52673	54	0.0	0.49214
31	0.0	0.44993	55	0.0	0.69516
32	0.0000	0.37291	56	0.0	0.60728
33	0.0000	0.39191	57	0.0	0.61456
34	0.0	0.67927	58	0.0	0.62930
35	0.0	0.41635	59	0.0	0.50800
36	0.0	0.54093	60	0.0	0.46782
37	0.0	0.67646	61	0.0	0.49712
38	0.0	0.60155	62	0.0000	0.33627
39	0.0	0.70247	63	0.0	0.54158
40	0.0	0.672737	64	0.0	0.43592
41	0.0	0.61369	65	0.0	0.66491
42	0.0	0.46503	66	0.0	0.45096
43	0.0	0.52391	67	0.0	0.68384
44	0.0	0.51285	68	0.0	0.49322
45	0.0	0.47612	69	0.0	0.43615
46	0.0000	0.38463	70	0.0	0.40725
47	0.0	0.47502	71	0.0	0.47616
48	0.0	0.57610	72	0.0	0.15467
50	0.0	0.56961	73	0.0000	0.35211
51	0.0	0.46460	74	0.0	0.39581
52	0.0	0.60606	75	0.0	0.46224

TABLE 9 continued .....

76	0.0	0.53253	96	0.0	0.59858
77	0.0	0.50875	97	0.0	0.64736
78	0.0000	0.34369	98	0.0	0.61244
79	0.0	0.43965	99	0.0	0.59511
80	0.0	0.44943	100	0.0	0.57036
81	0.0000	0.30151	101	0.0	0.61863
82	0.0000	0.27660	102	0.0	0.56617
83	0.0	0.59073	103	0.0000	0.33675
84	0.0	0.52143	104	0.0	0.52293
85	0.0	0.52963	105	0.0	0.46267
86	0.0	0.66801	106	0.0	0.56048
87	0.0	0.64482	107	0.0	0.41369
88	0.0003	0.15258	108	0.0	0.52352
89	0.0	0.68784	109	0.0	0.74805
90	0.0	0.77344	110	0.0	0.57276
91	0.0	0.56372	111	0.0	0.54529
92	0.0	0.62389	112	0.0	0.56741
93	0.0	0.59726	113	0.0000	0.34559
94	0.0	0.65520	114	0.0000	0.23748
95	0.0	0.60655	115	0.0	0.65053

A separate cluster analysis program, using a maximum acceptable decrease in KR20 option of 0.0010, was produced by the computer to establish skill clusters. Eight clusters of skills were found for the first 102 items in the Generic Data Skills Questionnaire. These are shown in Table 10.

TABLE 10. Clustering of Skills

Skill No.	Supervisor Cluster No.	Worker Cluster No.	Cluster Agreement	Conclusive* Cluster No.
1	1	6		1
2	1	6		1
3	8	6		1
4	1	6		1
5	1	1	X	1
6	1	7		1
7	1	7		1
8	1	7		1
9	1	1	X	1
10	1	1	X	1
11	1	1	X	1
12	1	1	X	1
13	1	1	X	1
14	1	1	X	1
15	1	1	X	1
16	1	6		1
17	1	1	X	1
18	1	1	X	1
19	1	1	X	1
20	1	1	X	1
21	1	1	X	1
22	1	1	X	1
23	5	1		1
24	1	1	X	1
25	5	3	X	5
26	5	3	X	5
27	5	3	X	5
28	1	1	X	1
29	3	1		3
30	3	1		3
31	1	1	X	1

*These clusters are in terms of supervisor clusters.

TABLE 10 continued ...

Skill No.	Supervisor Cluster No.	Worker Cluster No.	Cluster Agreement	Conclusive Cluster No.
32	1	1	X	1
33	3	1		3
34	1	1	X	1
35	3	1		3
36	1	1	X	1
37	5	3	X	5
38	5	1		5
39	5	3	X	5
40	5	3	X	5
41	1	3		1
42	6	4	X	6
43	8	4		6
44	5	3	X	5
45	5	3	X	5
46	5	3	X	5
47	8	8	X	8
48	8	8	X	8
49	5	3	X	5
50	8	8	X	8
51	4	5	X	4
52	4	5	X	4
53	4	5	X	4
54	4	5	X	4
55	4	5	X	4
56	4	5	X	4
57	8	8	X	8
58	2	1		8
59	7	8		8
60	8	5		8
61	4	1		4
62	6	6		6
63	6	4	X	6
64	6	2		6
65	2	4		6
66	2	4		6
67	6	4	X	6
68	6	4	X	6
69	6	8		6
70	6	4	X	6

TABLE 10 continued ...

Skill No.	Supervisor Cluster No.	Worker Cluster No.	Cluster Agreement	Conclusive Cluster No.
71	6	4	X	6
72	7	6	X	7
73	7	6	X	7
74	6	6		7
75	7	6	X	7
76	7	6	X	7
77	6	6		6
78	2	2	X	2
79	2	4		4
80	6	4	X	6
81	2	2	X	2
82	2	3		6
83	6	4	X	6
84	6	4	X	6
85	6	4	X	6
86	6	4	X	6
87	6	2		6
88	2	8		6
89	6	4	X	6
90	6	2		6
91	6	4	X	6
92	6	4	X	6
93	6	4	X	6
94	2	2	X	2
95	2	2	X	2
96	2	2	X	2
97	2	2	X	2
98	2	2	X	2
99	2	2	X	2
100	2	2	X	2
101	2	2	X	2
102	2	2	X	2

ANNEX A TO CHAPTER V

GENERIC SKILLS DATA SUMMARY

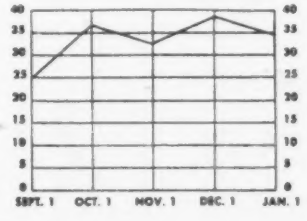
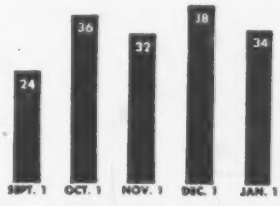
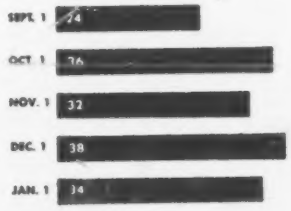
THE COMBINED DATA FROM 34 OCCUPATIONAL SUMMARIES
WITH PERCENTAGES CALCULATED ON A TOTAL OF 1360
POSSIBLE RESPONSES

ANNEX A TO CHAPTER V

QUESTIONS asked of 340 Workers (W) and their Supervisors (S) Percentage calculated on total of 1360 possible positive responses		SKILL USED				% on 1360
		On Job		On Job Entry		
		W	S	W	S	
MATHEMATICS						
1. USE OF NUMBERS - In which of the following ways do you use numbers in your work:						
A. Whole Numbers	Read	337	340	334	340	99
	Write	335	339	331	339	98
	Count	335	339	332	338	98
	Add or Subtract	323	332	319	330	95
	Multiply or Divide	302	313	299	312	90
	Round Off	290	299	288	296	86
B. Fractions	Read	266	249	263	245	75
	Write	263	248	261	244	74
	Add or Subtract	247	231	244	224	69
	Multiply or Divide	238	223	233	216	66
C. Decimals	Read	285	277	279	272	81
	Write	280	274	274	269	80
	Add or Subtract	263	261	257	257	76
	Multiply or Divide	250	245	245	238	71
	Round Off	244	244	239	234	70
D. Per Cent	Read	243	251	230	243	71
	Write	238	246	225	238	69
	Calculate With	212	225	197	213	62
E. Equivalents	Change Fractions to Decimals or Percentages	153	155	140	145	43
	Change Decimals or Percentages to Fractions	154	153	140	142	43
	Change Decimals to Percentages or Percentages to Decimals	147	150	135	140	42
F. Solve Problems in Word Forms	In your work do you ever have to do more than one of these calculations at a time and decide the order in which they are done.	189	189	163	168	52
G. Ratio and Proportion	Do you use ratio to show comparisons between two numbers. Example: gas oil mix 16:1, or compression ratio 8:1.	194	179	139	131	47
	Do you use proportion to solve problems like 4:6 = 3:( ). For example 4 gallons of gas requires 40 oz. of oil. How much oil would be needed for 3 gallons. $\frac{4}{40} = \frac{3}{(\ )}$	143	147	101	110	36
H. Areas Perimeters and Volumes	Does your work involve the calculation of:					
	Areas	118	110	106	93	31
	Perimeters	105	100	91	84	27
	Volumes (specify)	122	115	98	94	31

QUESTIONS asked of 340 Workers (W) and their Supervisors (S) Percentage calculated on total of 1360 possible positive responses		SKILL USED				% on 1360
		On Job		On Job Entry		
		W	S	W	S	
I. Algebra	Write problems in algebraic form at the one variable level: two plus a number is 5 2 + X = 5	33	36	30	33	09
	Simplify problems written in algebraic form at the one variable level: 3 (2X + 5) = 3 6X + 15 = 3	29	32	27	30	08
	Solve problems algebraically at the one variable level: Solve this problem by first writing a word sentence showing how the facts and unknown are related, then writing an open sentence and then solving the open sentence. Problem: Bill is 7 years older than his sister. If Bill is 21, how old is his sister?	26	28	22	27	07
	Write, simplify and solve two variable algebraic problems	12	19	9	18	04
	Write, simplify and solve quadratic problems	6	17	6	19	03
	Solve problems involving variations	6	17	6	15	03
J. Trigonometry	Use Tables of Logarithms	23	27	24	24	07
	Use a Slide Rule	30	29	16	17	06
	Perform Trigonometric Calculations (specify)	19	26	18	21	06
K. Geometry	In your work do you have to identify (recognize) common forms and figures such as circles, triangles, spheres, rectangles, squares, etc.	143	151	135	134	41
	Do you have to draw sketch or form these figures	110	111	89	87	29
	Do you have to read scale drawings such as blueprints	135	125	92	83	31
	Do you have to take measurements from scale drawings	93	95	53	62	22
	Do you have to draw to scale	51	55	32	35	12

ANNEX A TO CHAPTER V

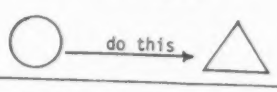
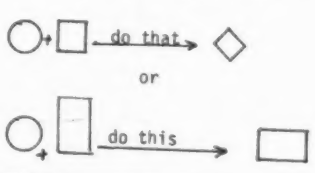
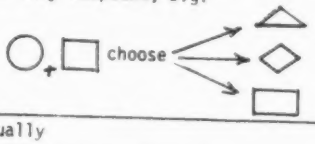
QUESTIONS asked of 340 Workers (W) and their Supervisors (S) Percentage calculated on total of 1360 possible positive responses		SKILL USED: On Job W	On Job S	On Job Entry W	On Job Entry S	% on 1360
2. MEASUREMENT						
A. In your work do you have to estimate any of the following units of measurement:	Time (e.g. how long it will take to do a job)	262	237	155	148	58
	Weight (how much something probably weighs)	152	159	88	95	36
	Distance (inches, feet, yards, miles)	173	169	116	128	43
	Area (square feet, square yards, etc.)	124	122	88	94	31
	Volume (cubic yards, gallons, bushels etc.)	129	140	73	79	30
B. In your work do you have to actually measure:	Time	208	189	156	146	51
	Weight	124	149	103	112	35
	Distance	153	156	119	111	39
	Quantity	190	183	145	144	48
C. In your work do you use any of the following units of measure:	Kilometre, metre, centimetre	46	43	28	26	10
	Kilogram, gram, milligram	27	30	15	16	06
	Kilolitre, litre, millilitre	27	26	16	15	06
D. In your work do you make use of tables to perform the following conversions:	kilometres metres centimetres to miles yards inches or reverse	23	28	12	15	05
	kilograms grams centigrams to pounds ounces or reverse	16	23	7	11	04
	litres millilitres to cubic inches cubic feet quarts gallons bushels or reverse	15	24	9	13	04
E. In your measurements do you read:	Scales such as postage meters, weigh scales, thermometers, etc.	217	219	136	139	52
F. Do you use verniers such as micrometers		90	88	51	57	21
3. GRAPHS						
						
						
						
	Does your work involve the use of graphs	76	97	46	55	20
	Do you record information on graphs	39	49	19	21	09
	Do you construct (draw) graphs	30	39	16	19	07

ANNEX A TO CHAPTER V

QUESTIONS asked of 340 Workers (W) and their Supervisors (S) Percentage calculated on total of 1360 possible positive responses		SKILL USED				% on 1360
		On Job		On Job Entry		
COMMUNICATIONS		W	S	W	S	
4. READING						
A. In your work do you read:	Notes, letters or memos	311	316	302	305	90
	Forms such as work orders, job orders, vouchers, claims purchase orders	304	303	224	220	77
	Charts (excluding maps, lists and two column tables)	209	220	134	127	50
	Policy manuals, regulations and instructions	288	289	157	162	65
B. In your work reading:	Do you only determine facts	319	319	268	266	86
	Have to determine opinions, purposes or hidden meanings	216	206	144	135	51
	Have to compare a given selection with a previous one	233	236	122	137	53
C. Do you use information from books such as:	Telephone directory Catalogue Dictionary Technical reference Company manual	303	312	245	253	81
Do you ever use more than one book at a time. e.g. - use a number of catalogues to find the cheapest item - locate information in a library		171	180	80	87	38
Do you compare references from two or more books and set a value or judgment on the one to use		136	148	59	59	29
5. WRITING						
A. In your work do you have to:	Write (compose) letters	150	157	149	154	44
	Write (compose) memos	239	243	218	212	67
B. Fill in or complete forms using:	Only short phrases and/or figures	282	279	255	256	78
	Sentences	194	197	179	180	55
	Paragraphs	138	153	132	144	41
C. Prepare reports which:	Show information but no suggestions or recommendations	156	167	73	86	35
	Include recommendations	90	101	32	36	19
D. Prepare reports which require you to:	Decide what information you need to do the job - (You, receive job instructions where you have to decide what information is required to do the jcb)	88	98	16	19	16
	Decide how to get the information - (You make up your own forms, or charts or procedures to get the information)	74	85	13	13	13
	Analyze the information - (You have to compare information against preset standards to determine which is most important and effective	46	62	9	16	09
	Evaluate the information - (You set the standards for analysis. This may include making lists of advantages and disadvantages of different items)	34	45	14	15	07

ANNEX A TO CHAPTER V

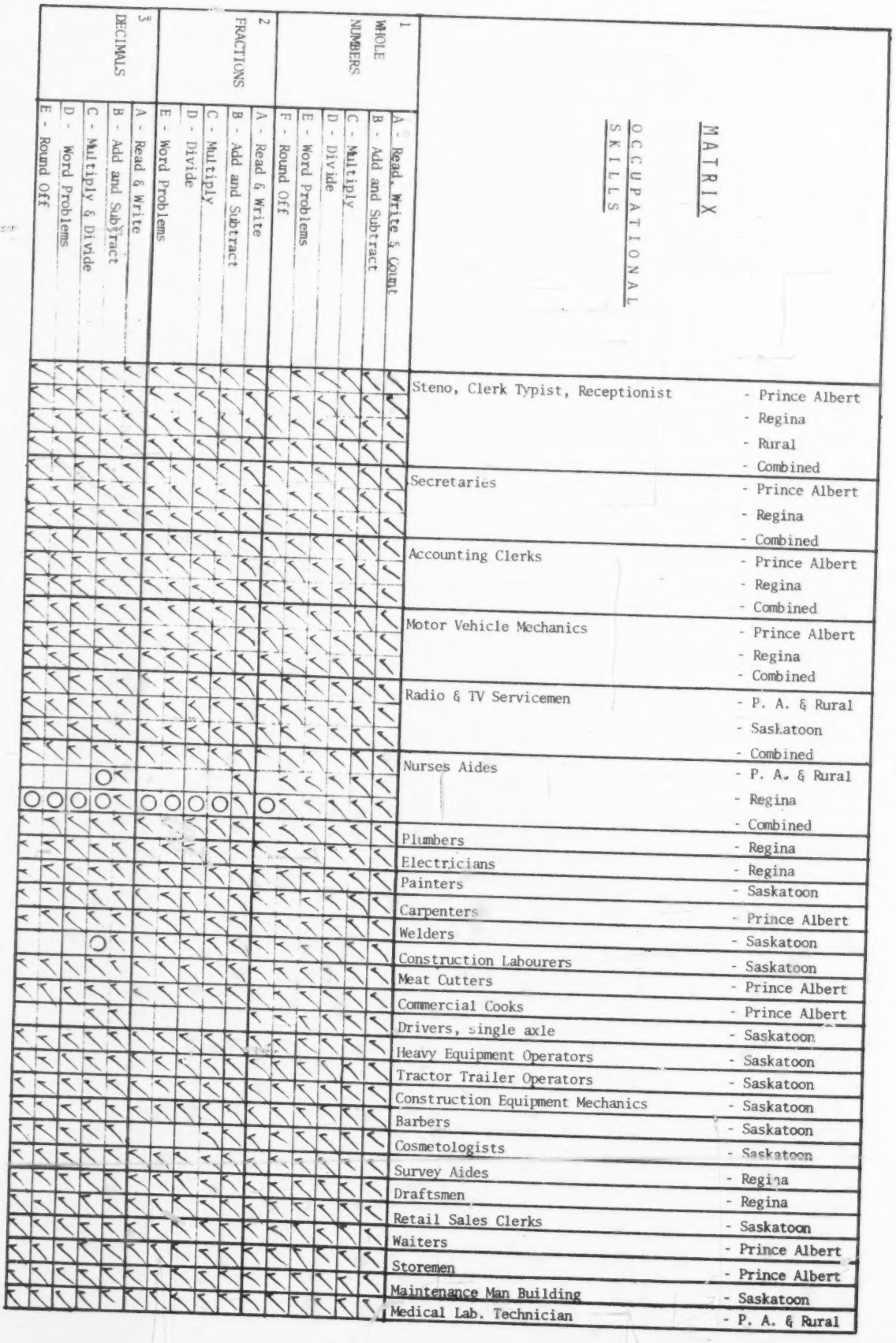
QUESTIONS asked of 340 Workers (W) and their Supervisors (S) Percentage calculated on total of 1360 possible positive responses		SKILL USED				% on 1360
		On Job		On Job Entry		
		W	S	W	S	
6. LISTENING - In your work do you receive oral (word of mouth) information or instructions which requires you to:	Only know the facts or directions	337	336	311	319	95
	Know opinions, purposes or hidden meanings	249	237	131	131	55
7. TALKING Do you talk to people in your work by:	Giving job directions or instructions	282	265	149	151	62
	Giving information	326	312	185	189	74
	Obtaining information by asking questions	329	313	225	238	81
	Giving formal talks	19	40	11	20	06
8. DISCUSSING A. In your work do you:	Debate with your fellow workers or customers to support your point of view, work methods or procedures	310	302	168	158	68
	Debate with your supervisor	321	318	155	143	68
	Take part in formal meetings or conferences which require you to present a point of view	150	167	62	65	32
B. Does your work involve:	Sorting information or objects by a given list. e.g. - sort and file correspondence - sort vouchers by types - sort expenditures or receipts - sort parts or tools	249	264	133	130	57
	Setting up the lists for sorting the information or objects. e. g. - prepare forms to record correspondence, telephone calls, or list of visitors - prepare sub headings or breakdowns for expenditures or receipts - prepare forms to record information you believe others have a need to know - prepare file systems	182	181	84	86	39
9. DIAGNOSING Some workers use what are known as diagnostic skills. They examine symptoms (or faults) to determine the problem which causes the symptom. Doctors use these skills to determine the reasons for our aches and pains. Mechanics also use these skills to determine why a car won't start or doesn't run properly. We are trying to find out whether or not you use diagnostic skills and if so which ones. In your work do you:	Ever have to determine the possible reason why something does not work or why mistakes have been made.	238	231	129	110	52
(If this is a negative answer ignore the remaining questions in 9.)						

QUESTIONS asked of 340 Workers (W) and their Supervisors (S) Percentage calculated on total of 1360 possible positive responses		SKILL USED				% on 1360
		On Job		On Job Entry		
		W	S	W	S	
A. Do you:	Ever have to list, state or think of possible reasons which might cause certain faults or symptoms	209	194	95	77	42
	Use reference manuals to guide you in selecting the possible reasons	149	150	69	63	31
	Ever have to establish a priority or sequence in which to check the possible reasons	177	167	85	72	36
	Have to personally check to find out which of the possible reasons is the correct one	197	180	97	82	40
	Use reference manuals to guide you in how to check each reason	129	128	60	58	27
B. If you do have to check to find out which of several possible problems is the correct one do you do this by:	Asking probing questions	183	182	99	102	41
	Examining by, smelling, touching, looking at or tasting	206	190	121	101	45
	Using tools or instruments	150	138	88	74	33
C. If you make an error in your diagnosis would it possibly result in:	Loss of life	59	49	34	23	12
	Some danger or hazard	96	87	50	38	19
	Considerable loss of time	92	93	51	48	20
	Some loss of time	126	111	67	64	27
	Considerable financial loss	93	99	44	53	21
	Some financial loss	128	114	73	71	28
10. INSTRUCTIONS						
A. How complicated are the instructions you follow in carrying out your job:	Are they simple, e.g. If this happens 	331	322	251	256	85
	Are they complex, e. g. If this and this happen 	290	276	149	127	61
	Are they compound, e.g. 	262	228	91	66	47
B. In performing your job, how often do you establish your own work priorities:	Usually	217	200	57	43	38
	Sometimes	81	65	77	64	21
	Rarely	19	41	39	40	10
	Never	24	33	117	133	22

ANNEX B TO CHAPTER V

MATRIX

OCCUPATIONAL SKILLS



ANNEX B TO CHAPTER V

15 READ	A - Literal Comprehension
	B - Interpretive & Evaluative
	C - Comparative Evaluation #1
	D - Books
	E - Comparative Evaluation #2
	F - Comparative Evaluation #3
16 BUSINESS READ	A - Notes, letters & memos
	B - Forms
	C - Charts
	D - Manuals
17 WRITE	A - Phrases
	B - Sentences
	C - Paragraphs
	D - Forms
	E - Memos
	F - Letters
18 WRITE REPORTS	A - Information Reports
	B - Recommendation Reports
	C - Sort
	D - Classify
	E - Tech. Reps.
19 EXCHANGE IDEAS	A - Debate
	B - Peer Debate
	C - Supervisor Debate
	D - Conferences
20 DIAGNOSE	A - List Causes
	B - Look Up Causes
	C - Set Priorities
	D - Look Up Methods
	E - Probing Questions
	F - Use Senses
21 LATITUDE	A - Simple Instrs.
	B - Complex Instrs.
	C - Compound Instrs.
	D - Set Priorities

MATRIX

OCCUPATIONAL SKILLS

| | | |

INTERVIEW NO. _____

INTERVIEWER _____

GENERIC DATA SKILLS QUESTIONNAIRE

Date of Interview _____

CCDO Occupation. _____ No. _____

Company/Organization _____

Address _____ Phone No. _____

Person Interviewed _____

Worker _____

(Name and Title)

Supervisor _____

(Name and Title)

Instructor _____

(Name and Title)

NOTES TO INTERVIEWER

- The purpose of this questionnaire is to determine, by questioning, the generic data skills which are used on the job and, of those, which ones were required on entry to the job.
- SKILLS HELD BUT NOT USED ON THE JOB ARE NOT TO BE RECORDED.
- The worker and supervisor should not be shown each other's responses.
- MAKE NO ASSUMPTIONS. SKILLS USED ON THE JOB ARE FREQUENTLY DIFFERENT FROM WHAT YOU MAY EXPECT.
- If the interviewee does not understand a question, rephrase it.
- If in doubt about a response, ask for an example or for an explanation of the skill used. Specify the exact application of the skill used where you consider it appropriate.
- For supervisor interviews, paraphrase questions to identify skills used by the worker to be interviewed.
- For instructor interviews, paraphrase questions to identify skills needed to participate in the occupational training course (on job entry) and skills developed by the course (on job).

Instrument developed by:

Training Research and Development Station

Department of Manpower and Immigration

Prince Albert, Saskatchewan

ANNEX C TO CHAPTER V - REVISED VERSION OF QUESTIONNAIRE

QUESTIONS		SKILL USED		
		SER.	ON JOB	ON JOB ENTRY
1. USE OF NUMBERS - In which of the following ways do you use numbers in your work:				
A. Whole Numbers	Read	1		
	Write	2		
	Count	3		
	Add or Subract	4		
	Multiply or Divide	5		
	Round Off	6		
B. Fractions	Read	7		
	Write	8		
	Add or Subtract	9		
	Multiply or Divide	10		
C. Decimals	Read	11		
	Write	12		
	Add or Subtract	13		
	Multiply or Divide	14		
	Round Off	15		
	Use decimals only with respect to dollars and cents	15A		
D. Per Cent	Read	16		
	Write	17		
	Calculate % of a number (5% of 3.00 = ___).	18		
	Calculate % one number is of another (75 is ___ % of 90).	18A		
	Calculate a number when a % of it is known (10% of ___ = 70).	18B		
	Calculate the average of a group of numbers.	18C		
E. Equivalents	Change Fractions to Decimals or Percentages	19		
	Change Decimals or Percentages to Fractions	20		
	Change Decimals to Percentages or Percentages to Decimals	21		

ANNEX C TO CHAPTER V - REVISED VERSION OF QUESTIONNAIRE

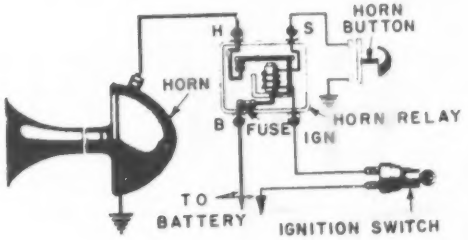
QUESTIONS		SKILL USED		
		SER.	ON JOB	ON JOB ENTRY
F. Solve Problems In Word Forms	In your work do you ever have to select the type of math operations and, if more than one, decide the order in which they are done?	22		
G. Ratio and Proportion	Do you use ratio to show comparisons between two numbers? Example: gas oil mix 16:1, or compression ratio 8:1.	23		
	Do you use proportion to solve problems like 4:6 = 3: ( )? For example 4 gallons of gas requires 40 oz. of oil. How much oil would be needed for 3 gallons? $\frac{4}{40} = \frac{3}{(\ )}$?	24		
H. Areas, Perimeters and Volumes	Does your work involve the calculation of: Areas	25		
	Perimeters	26		
	Volumes (specify)	27		
I. Algebra	Solve problems algebraically at the one variable level: Solve this problem by first writing a word sentence showing how the facts and unknown are related, then writing an open sentence (equation) and then solving it. Problem: There are 3 times as many workers on the day shift as on the night shift. The total number of workers is 30. How many are on the night shift?	30		
	Do you make use of formulas such as $V = \frac{3M + Y}{Z}$ and have to insert the quantities for M, Y and Z and solve for V?	30A		
	Write, simplify and solve two variable algebraic problems.	31		
	Write, simplify and solve quadratic problems	32		
J. Trigonometry	Use tables of Logarithms	34		
	Calculate with a Slide Rule	35		
	Perform Trigonometric Calculations (specify)	36		

ANNEX C TO CHAPTER V - REVISED VERSION OF QUESTIONNAIRE

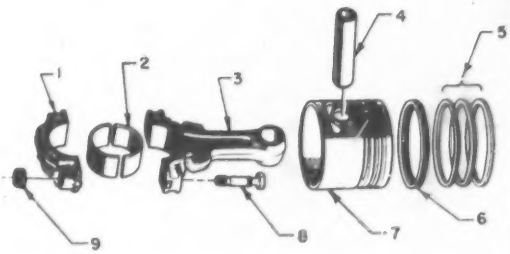
QUESTIONS		SKILL USED		
		SER.	ON JOB	ON JOB ENTRY
K. Geometry	In your work do you have to identify (recognize) common objects such as circles, triangles, spheres, rectangles squares, etc.	37		
	Do you have to recognize common angles such as 15 , 30 , 45 , and 90 ?	37A		
	Do you draw, sketch, or form these figures?	38		
	Do you read scale drawings such as blueprints?	39		
	Do you have to read assembly drawings?	39A		
	Do you have to read schematic drawings?	39B		
	Do you take measurements from scale drawings?	40		
	Do you draw to scale?	41		

DRAWINGS :

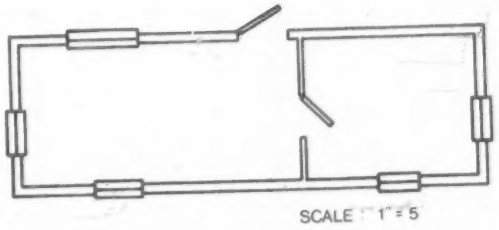
Schematic :



Assembly :



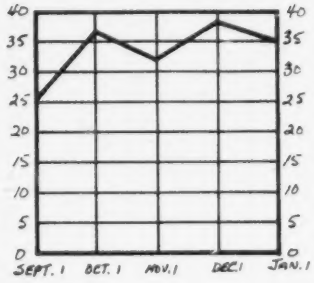
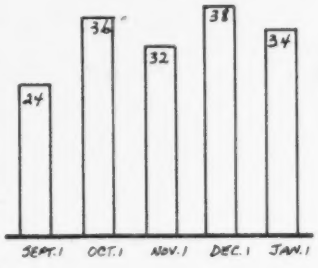
Blueprint :



ANNEX C TO CHAPTER V - REVISED VERSION OF QUESTIONNAIRE

QUESTIONS		SKILL USED		
		SER.	ON JOB	ON JOB ENTRY
2. MEASUREMENT				
A. In your work do you have to estimate any of the following measurements:				
	Time (e.g. how long it will take to do a job)	42		
	Weight (how much something probably weighs)	43		
	Distance (inches, feet, yards, miles)	44		
	Area (square feet, square yards, etc.	45		
	Liquid volume (quarts, gallons, etc.)	46		
	Spatial volume (cubic yards, cubic inches, etc.)	46A		
B. In your work do you have to actually measure:				
	Time	47		
	Weight	48		
	Distance	49		
	Liquid Volume	50		
C. In your work do you use any of the following units of measure:				
	Kilometre, metre, centimetre	51		
	Kilogram, gram, milligram	52		
	Kilolitre, litre, millilitre	53		
D. In your work do you make use of tables to perform the following conversions:				
	Kilometres metres centimetres to miles yards or reverse inches	54		
	Kilograms Grams Centigrams to pounds or reverse ounces	55		
	Litres Millilitres Cc's to cubic inches cubic feet quarts or reverse gallons bushels	56		
E. In your measurements do you read:				
	Scales such as postage meters, weigh scales, thermometers, etc.	57		

ANNEX C TO CHAPTER V - REVISED VERSION OF QUESTIONNAIRE

QUESTIONS	SKILL USED		
	SER.	ON JOB	ON JOB ENTRY
F. Do you use vernier scales such as micrometers?	58		
3. GRAPHS			
Does your work involve the use of graphs?	59		
Do you record information on graphs?	60		
Do you construct (draw) graphs?	61		
 			
4. READING			
A. In your work do you read:			
Notes, letters or memos	62		
Forms such as work orders, job orders, vouchers, claims, purchase orders	63		
Charts (excluding maps, lists and two column tables)	64		
Policy manuals, regulations and instructions	65		
Roman numerals: I, IV, X	65A		
up to X	65B		
up to XXX	65C		
up to L	65D		
C and over	65E		
B. In your work reading:			
Do you only determine facts?	66		
Do you have to determine opinions, purposes or hidden meanings?	67		
Do you have to compare a given selection with a previous one?	68		

ANNEX C TO CHAPTER V - REVISED VERSION OF QUESTIONNAIRE

QUESTIONS	SKILL USED		
	SER.	ON JOB	ON JOB ENTRY
C. Do you use information from books such as: Telephone directory Catalogue Dictionary Technical reference Company manual	69		
Do you ever use more than one book at a time? e.g. - use a number of catalogues to find the cheapest item - locate information in a library	70		
Do you compare references from two or more books and set a value or judgment on the one to use?	71		
5. WRITING			
A. In your work do you have to:			
Write (compose) external letters	72		
Write form letters only	72A		
Write single paragraph letters only	72B		
Write (compose) internal memos or letters	73		
Write only short notes	73A		
B. Fill in or complete forms using:			
Short phrases and/or figures	74		
Sentences	75		
Paragraphs	76		
C. Prepare reports which:			
Show information but no suggestions or recommendations	77		
Include recommendations	78		
D. Prepare technical reports which require you to:			
Decide what information you need to do the job (You receive job instructions where you have to decide what information is required to do the job.	79		
Decide how to get the information - (You make up your own forms, or charts or procedures to get the information.)	80		
Analyze the information - (You have to compare information against preset standards to determine which is most important and effective.)	81		
Evaluate the information - (You set the standards for analysis. This may include making lists of advantages and disadvantages of different items.)	82		

ANNEX C TO CHAPTER V - REVISED VERSION OF QUESTIONNAIRE

QUESTIONS	SER.	SKILL USED ON JOB	SKILL USED ON JOB ENTRY
6. LISTENING In your work do you receive oral (word of mouth) information or instructions which require you to:			
Know the facts or directions	83		
Understand opinions, purposes or hidden meanings	84		
7. TALKING Do you talk to people in your work by:			
Giving job directions or instructions	85		
Giving information	86		
Obtaining information by asking questions	87		
Giving formal (prepared) talks	88		
8. DISCUSSING In your work do you:			
Debate with your fellow workers or customers to support your point of view, work methods or procedures	89		
Debate with your supervisor	90		
Take part in formal meetings or conferences which require you to present a point of view	91		
9. SORTING/CLASSIFYING Does your work involve:			
Sorting information or objects by a given list. e.g., -sort and file correspondence -sort vouchers by types -sort expenditures or receipts -sort parts or tools	92		
Setting up the lists for sorting the information or objects. e.g., -prepare forms to record correspondence, telephone calls, or list of visitors -prepare sub-headings or breakdowns for expenditures or receipts -prepare forms to record information you believe others have a need to know -prepare file systems	93		

QUESTIONS		SKILL USED		
		SER.	ON JOB	ON JOB ENTRY
10. DIAGNOSING				
Some workers use what are known as diagnostic skills. They examine symptoms (or faults) to determine the problem which causes the sypmtom. Doctors use these skills to determine the reasons for our aches and pains. Mechanics also use these skills to determine why a car won't start or doesn't run properly. We are trying to find out whether or not you use diagnostic skills and if so which ones.				
In your work do you:	Ever have to determine the possible reason why something does not work or why mistakes have been made	94		
(IF THERE IS A NEGATIVE ANSWER IGNORE THE REMAINING QUESTIONS IN 10).				
A. Do you:	Ever have to list, state or think of possible reasons which might cause certain faults or symptoms	95		
	Use reference manuals to guide you in selecting the possible reasons	96		
	Ever have to establish a priority or sequence in which to check the possible reasons	97		
	Have to personally check to find out which of the possible reasons is the correct one	98		
	Use reference manuals to guide you in how to check each reason	99		
B. If you do have to check to find out which of several possible problems is the correct one do you do this by:	Asking probing questions	100		
	Examining by smelling, touching, looking at or tasting	101		
	Using tools or instruments	102		
C. If you make an error in your diagnosis would it probably result in:	Loss of life	103		
	Some danger or hazard	104		
	Considerable loss of time	105		
	Some loss of time	106		
	Considerable financial loss	107		
	Some financial loss	108		

QUESTIONS	SER.	SKILLS USED: ON JOB	SKILLS USED: ON JOB ENTRY
11. LATITUDE AND COMPLEXITY			
Which of the following most nearly describe your job:			
A. Tools, Equipment and Materials used:			
Are all specified and you have no choice in what to use?	116		
Some are specified. For others you use guides such as manuals, charts, etc., to help you decide.	116A		
You have to decide, without direction or guides, which tools, equipment or materials to use.	116B		
B. Procedures and methods used:			
All are specified and you have no choice in the procedures or methods used	117		
Some are specified. For others you use guides such as manuals and operating procedures, etc., to help you decide on methods & procedures.	117A		
You have to decide, without direction or guides, which methods and procedures to use	117B		
C. Information to do your jobs:			
All information needed to do your jobs is included in the assignment.	118		
You have to examine trade manuals, charts, etc., to obtain some information needed to do your job.	118A		
You have to recall or look up various theories (NOT just tables, formulas or facts) as part of the information needed to do your jobs.	118B		
Your jobs require the use of creative theory beyond standard professional and trade literature.	118C		
D. Products or services performed (jobs done at work):			
Are completely specified and you have no choice in the results achieved.	119		
You have some choice in deciding the specific product or service performed.	119A		
You have various options in what to do and have to investigate and evaluate each of them to decide on the specific outputs of your work.	119B		
There is some question on what products or services should be expected as a result of your work, and you have to control and explore many variables and formulate possible results to decide the specific outputs of your work.	119C		

QUESTIONS	SKILL USED		
	SER.	ON JOB	ON JOB ENTRY
E. Latitudes between jobs (complete jobs such as fix that car, frame a wall, type this letter, do room 4, etc.):			
You have no choice or option in which job to do next.	120		
You are given job sequences for some jobs and have a choice in sequence for others.	120A		
You are given required completion time for some jobs and have a choice in sequencing them.	120B		
Except for some priority jobs you have nearly complete independence in sequencing your jobs.	120C		
FOR SUPERVISORS ONLY			
1. Is there a compulsory academic requirement for entry into this position?			
Grade - specify			
or			
Adult Equivalency - specify			
2. Are any vocational training courses required for entry into this position?			
- specify			

CHAPTER VI

GENERIC DATA SKILLS - DEVELOPMENT SPECIFICATION

The aim of this chapter is to specify the purpose and content for generic skills training packages to be developed by the Training Research and Development Station. These will be discussed under the following headings:

1. Purpose of Training Packages.

2. Content and Organization of Training Packages.

The following components are to be prepared as a result of the development work outlined in this chapter:

1. A discrete curriculum package for each unit. These packages are to include:
   a. the instructional objectives
   b. diagnostic and placement tests
   c. references by objectives to appropriate learning materials which have been selected or developed, and
   d. achievement tests.

2. An instructors' manual which includes information on the background, objectives, components, individualized process and procedures needed to implement and operate the program.

3. An answer book for all diagnostic, placement and achievement tests.

4. Individualized learning packages for those items where suitable or sufficient learning materials are not available in published materials.

A - PURPOSE OF TRAINING PACKAGES

The training packages are to be designed to facilitate achievement of the following objectives:

1. To assist students to achieve the specific generic data skills which are required for chosen occupations.

2. To allow students to gain recognition for skills attained outside the educational system.

3. To provide remedial academic upgrading for those who have the official prerequisites but have forgotten the actual skills or knowledge.

4. To enable continuous intake and exit of students.

5. To provide a process by which adults may identify and acquire additional generic data skills required to advance their careers.

It is forseen that the training packages will be implemented by occupational training institutions in a variety of situations, such as:

1. Using the program to prepare students for occupational training courses or for job entry.

2. Using the content of the program as a vocational guide to help students establish appropriate occupational goals.

3. Integrating the program with occupational training courses by allowing training time daily for the development of the generic data skills.

4. Unifying this program with occupational training courses by treating the data concepts and the occupational skill requirements as a unit.

It is also forseen that the training packages will be used by employers:

1. In conjunction with CMTP Training on the Job (TOJ) programs.

2. In conjunction with company on job training (OJT) programs.

3. To facilitate career programs by employers.

4. To permit recognition of data skills learned by experience on the job.

B - CONTENT OF TRAINING PACKAGES

The content to be covered by the training packages are shown in the following:

1. The scope and content are shown in the skill content chart attached as Annex B to Chapter V.

2. The occupational profiles are included as Appendix 4 (to the technical report).

3. A matrix of occupations and skills is attached as Annex C to Chapter V.

4. The instructional objectives for the items included are at Appendix 5.

5. Skill clusters are included as Table 10.

The developers must carefully study the preceeding chapters, with special attention to Chapter V, to ensure that they have a thorough understanding of the rationale and processes used to identify and analyze the generic data skills.

It is important to realize that the content has not been arranged in a learning hierarchy. In essence, the preceeding work has been an identification of data skills which are common to many occupations and a further level of identifying their actual use by the occupations which were analyzed. The evidence contained in this report must be carefully studied before making any assumptions about sequenced skill development. Many of the items will have to be designed as discrete skills to ensure that students do not have to attain extraneous skills based on a traditional sequence of learning. For example, some workers who have to calculate volumes (item 10C) do not also have to calculate areas and perimeters (items 10A and 10B).

The instructional packages are to be developed for a target population who are at least functionally literate. Adults who can achieve a measured Grade IV in the reading component of standard tests such as the Canadian Test of Basic Skills should be able to achieve the required skills included in the instructional packages.

The objectives at Appendix 5 to this report do not necessarily include the enabling skills required by adults who are unable to achieve these behaviors. It will be recalled (Chapter II) that judgment was exercised, in the design of the data collection instrument, in the belief that a number of enabling or subordinate skills could be identified on the basis of the functional skills carried out by the workers. Data were not collected on skills such as spelling requirements, diction, use of prefixes and suffixes - nor was data collected on knowledge items such as mathematics nomenclatures, (numerator, denominator, subtrahend, etc.), purpose of nouns, verbs, adverbs and prepositions. The developers will therefore necessarily have to identify and build into the curriculum two types of enabling objectives:

1. Subordinate skills which can reasonably be considered to be subsumed by the objectives at Appendix 5. For example, the skill of writing letters necessarily imply some ability to spell words.

2. Prerequisite skills which students necessarily have to attain before they would be able to learn the instructional objectives at Appendix 5. For example, students who are learning elementary arithmetic skills will probably have to learn the meanings of certain symbols and words.

Caution must be exercised in the selection and in the use of these additional curriculum objectives. Because these are to be inserted on the basis of judgment rather than on empirical evidence, the development staff should restrict their use to those which are an obvious requirement and be extremely careful when using them for diagnostic or achievement tests. We have, for example, evidence that most of the occupations surveyed have to be able to multiply and divide fractions but we have no evidence to suggest that they have to be able to correctly identify the words numerator and denominator, even though the use of these skills may help develop the skills of handling fractions.

From the preceeding paragraphs it will be seen that the development staff will necessarily have to prepare or develop the following:

1. Enabling objectives designed to help those who cannot perform the instructional objectives.

2. Subordinate objectives which can be subsumed from the instructional objectives.

3. Test items to be used for diagnostic, prescription and achievement purposes.

4. A master sequential learning model to ensure that students, who are unable to achieve any or all of the required skills, learn them in an appropriate order or sequence.

The developers are not restricted to the item and unit configurations shown in the skill content chart, profiles and objectives. In fact, they will necessarily have to re-structure them to accommodate the enabling and subordinate objectives which they include. They may also have to contract or expand others. They will, perforce have to prepare conversion tables or charts to supplement or replace the occupational profiles and matrix of skills and occupations shown in Appendix 4 and in Annex C to Chapter V.

To fulfil the specified objectives the developed program should embrace the following types of individualization:

1. Individualized Content. The skills to be attained by each student to be based on his occupational goal, with institution and/or student options, as suggested in the appropriate occupational profiles.

2. Individualized Process. Continuous intake and exit of students to be easily administered. Students to be given necessary diagnostic and prescription tests to determine skill development needs and be allowed when reasonable and possible, a wide selection of learning materials in various media.

3. Individualized Pacing. Students to be allowed to develop skills at a pace consistent with their learning abilities. Achievement tests to be capable of individual or small group administration based on the appropriate time to meet student rather than administrative needs.

Many of the exercises and tests should involve operant as well as respondent behavior. For example, it is more important that a worker be able to state and support a conclusion reached from oral or written material than that he should be able to identify a correct conclusion. Certainly factually correct responses are required at the literal comprehension level but operant behavior becomes important at the interpretive and evaluative levels of comprehension.

As previously mentioned, the content has not been ordered or sequenced- nor have the mathematics and communications units been separately classified by these titles. This will allow the developers to integrate the learning experiences so the students can congruently learn and apply mathematics and communications concepts rather than as artificial subject separation.

The processes used in LINC (Learning Individualized for Canadians), as discussed in Chapter VII, will be used for the development of these training packages.

CHAPTER VII

CURRICULUM PROGRAM FOR GENERIC DATA SKILLS

The Training Research and Development Station has developed a program in basic education to prepare undereducated adults as quickly as possible to enter vocational training and to handle the requirements of reading, writing and arithmetic in everyday life. The program had to cover an academic range from about Grade 5 to Grade 10, the level specified by most provinces as the necessary prerequisite to training in vocational skills. The program, known as LINC: Learning Individualized for Canadians, is now being extended to cover the full range of Data skills.

The program is individualized adult basic education, thus making possible a system of continuous intake and exit. Such a system allows adult students to enter a program whenever they are ready, without waiting for a fixed graduation day. Other students can be enrolled to fill a training place as soon as it becomes vacant. In that way there can be a more effective use of instructors and classrooms, costs per training day can be lowered, and students waste less time in training.

The LINC program satisfies these needs at two levels of individualization; it is arranged so that provinces can adapt it easily to meet their varying requirements of standards and content, and its systems approach provides a process of complete individualization for continuous intake and exit.

Basically its content satisfies the core requirements of all or most provinces, but its process allows content units to be added, subtracted, or changed to fit a range of provincial curricula. Its system of prescription allows each teacher to include his own favourite textbooks and methods. Its system of evaluation allows criteria at check points to be adjusted to fit local standards. Courses other than the mathematics and communications of the LINC program can be modelled on its process. LINC thus serves as a framework on which to build the variations required by the provinces and the institutions which provide adult basic education in each province.

A - THE LINC PROGRAM

The LINC program package may be considered from three points of view: the components, the content, and the process.

Components

The components are the three courses: Mathematics, Developmental Reading, and Functional Reading. Developmental Reading is concerned with teaching the skills of receiving oral and written information and comprehending, interpreting and evaluating it. Functional Reading, on the other hand, deals more with transmitting information, mostly by writing, and with the usages which make correct writing possible.

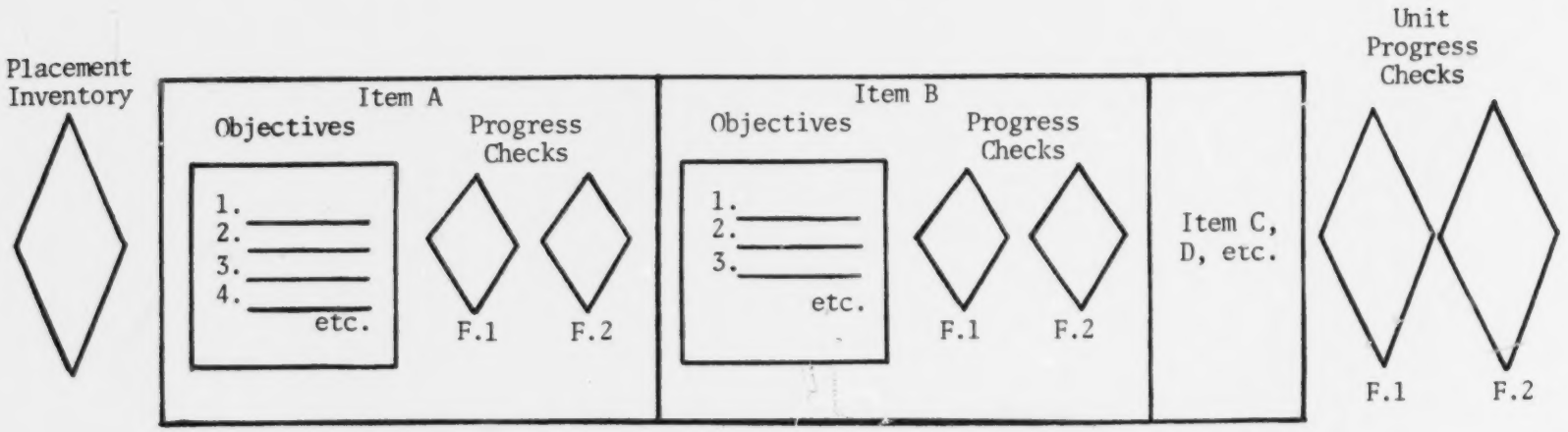
Content

Behavioural objectives define the content of the program in a range of difficulty from about Grade 5 to Grade 10. To make the individualized process work, objectives are grouped into homogeneous concept items, and items in turn are arranged in units. Mathematics, for example, has ten units sub-divided into a total of 45 items which in turn include 266 learning objectives. (See Table II: The Organization of a LINC Unit.)

The objectives make the heart of the LINC program. They keep the units internally consistent, and they control the stages of difficulty by their grading. All the evaluation instruments - the placement inventory, the short term item checks, and the longer range unit checks - are based on the item objectives. Evaluation and even student progress is expressed visually when a student crosses each objective off his chart after he has shown mastery of it at both the item and unit level; the chart of objectives shows both student and instructor what he has done and what remains to be done for him to complete the program. Thus progress is rated not in terms of a series of percentage marks but of objectives for which the criterion has been met. Students are expected to master every objective in the program; some do it quickly and others more slowly. Time, then, and not what fraction of a program a student has passed an examination on, becomes the individual variable. (Note that content will also be an individual variable in the revision now being prepared for data skills.)

The content of LINC was limited to Mathematics and various aspects of Communications as core necessities in providing students with at least the minimum essentials to qualify to enter vocational training, to get an academic certificate that would open doors to jobs which require that level of education, and to cope with the practical needs of daily living. Now, for the Generic Skills project, LINC is being extended to include the mathematics and communications skills required as part of vocational training.

TABLE II: The Organization of a Linc Unit



This unit organization is repeated throughout the program, with varying numbers of items in each unit, varying numbers of objectives in each item, and two forms of each progress check.

Process

The process is the system of diagnosis, placement, prescription and evaluation which makes possible the individualization of the program, both for the student in the classroom and for the institution which wants to adapt the program to suit its own requirements. (See Table 12: Individualized Process.)

The process is designed for individualized instruction for students in three well-defined steps:

1. Diagnosis and Placement

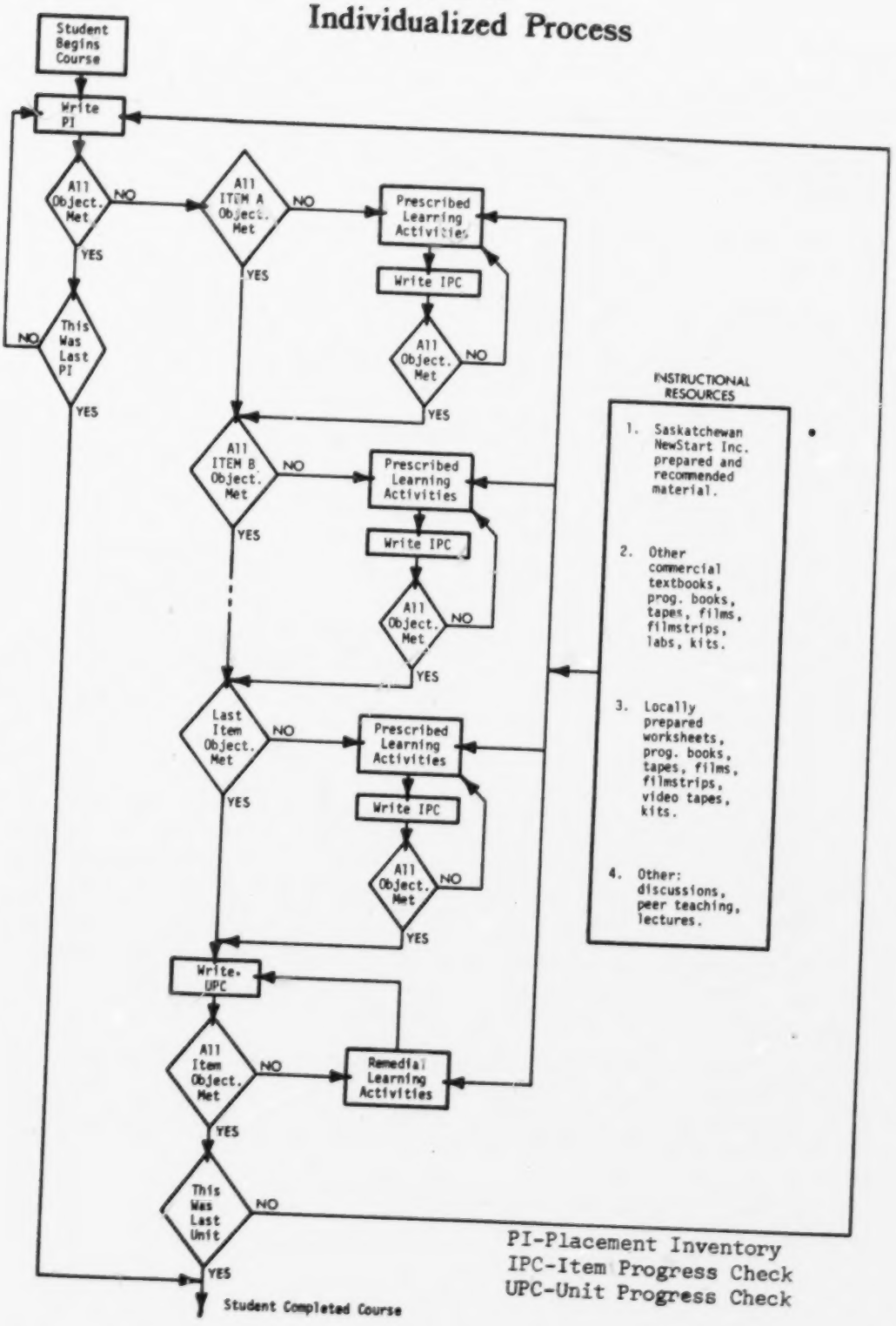
Every unit in the program begins with a placement inventory in which there is at least one question on every instructional objective in the unit. Students are placed according to the objectives they are unable to meet. When a course begins, naturally, everybody may take the placement inventory for Unit 1 of a course at the same time, but the students soon spread out. Some students make mistakes immediately and they must be assigned work on the unit. Other students may breeze through several placement inventories before they have to stop. Within a short time all the students are working at different levels. As students complete the program or drop out to take jobs or for other reasons, other students take their empty seats in a continuous intake-exit situation. These new entrants start with the first placement inventory themselves. Thus after the first day there is no set time for placement testing; it must go on continually.

Placement is important for adult students who are returning to school after a number of years away. They want to find out what they know and what they don't know, what they have completed and what they still have to finish to reach a certain goal. Placement related to objectives forces a student to face the truth of his functioning level; he cannot hide behind a vague grade level. Placement helps to make him responsible for his own learning, and that is an important aspect of an individualized program for adults. Furthermore, as he shows mastery of certain objectives, either on placement inventories or further evaluation checks, he feels a sense of satisfaction and accomplishment.

At the same time, by diagnosing a student's weaknesses and strengths and by placing him correctly, an instructor begins to understand him. Placement is the first step in a fuller diagnosis of the student's capabilities, so that during the whole training

TABLE 12

Individualized Process



PI-Placement Inventory
IPC-Item Progress Check
UPC-Unit Progress Check

program the instructor can prescribe the best materials and use the best methods to fit the student's level and to match his particular learning abilities.

2. Prescribed Learning Activities

Before an instructor can prescribe work successfully for an adult student, he has to do more than analyze his mistakes on paper. At the prescription stage the instructor should sit down with each student, examine the mistakes he has made and relate them to the objectives which state what must be learned. The student must learn to face his mistakes and realize what has to be done to overcome them.

In this personal contact the instructor can begin to develop the one-to-one relationship which is so important in adult basic education. Perhaps personal and social difficulties may be explored at the same time as the academic. The instructor may not be able to perform fully as a counsellor or to settle the student's life problems at this point, but he can at least lend a sympathetic ear. The ability to establish a good relationship with a student, to show empathy and understanding, may be more important attributes for an instructor than pedagogical skills.

In prescribing, the instructor's big task is to match materials and methods with an individual's learning needs. Because in most training programs there is such a wide spread of individuals, adults with differing backgrounds of knowledge and attitudes in addition to differing intellects, interests, and capabilities, no single textbook or set of materials or isolated method can satisfy all individual requirements. Some people learn best in short steps, others in longer; some grasp new principles quickly, others need more explanations or more examples or more reinforcement. A set of books aimed at the average adult student (or, too often in adult programs, the average child) can satisfy neither the slow learner at one end of the scale nor the fast learner at the other. Some students prefer programmed materials, with a chance to check results after every frame; others prefer workbooks with lots of drill on every new concept; still others feel cheated if they are not given an old-fashion textbook such as they may have used in school years before.

The same observations have been made about methods. One student learns best by reading a textual explanation, another by looking at a visual presentation or illustration, a third by hearing

an explanation. A student may freeze during a teacher's explanation and not remember a word, but he may absorb fully the explanation of a peer for whom he has no fear, especially if that person has just faced the same problem and has overcome it. Some students still want to learn in traditional class groups, with the instructor giving a group lesson with assignments based on it.

Thus the instructor must be prepared to draw on a wide repertoire of materials and approaches in order to match them in his prescriptions for the particular needs of a particular student. That means that an instructor must be well acquainted with a good stock of resources. He must know their strengths and weaknesses and suitability for different students. He has to be able to orchestrate them progressively in his prescriptions, bringing them in at the right moment, particularly in reading programs. Finally, if commercial materials and the usual methods fail, a good instructor must be capable of creating his own materials and methods to zero in precisely on the student's problem.

The LINC program recommends only a basic set of commercial books for classroom use. Each classroom needs only a few copies of each since students are working at different levels, perhaps on different courses, at one time. Any institution implementing the LINC program may use their own supply of materials instead of those recommended or they can add them to the basic set to make it more comprehensive.

3. Evaluation

The LINC program has three levels of evaluation. At first the placement inventory reveals the item and objective each student must start work on. When a student completes work on all the objectives of an item, and both the instructor and the student are satisfied that he is ready for the test, he takes the item progress check immediately. If he reaches the criterion score, he continues work on further items until he completes the unit. He then takes the unit progress check, which tests the objectives of all the items in an integrated way. A final evaluation when the student has completed the course checks the student's retention of all the objectives in the course. (See Tables 11 and 12)

All the item and unit progress checks have two forms. The recommended criterion on all Form 1 checks is complete mastery. A mistake indicates the need for a further prescription, preferably with different materials or a new method, to give the student a fresh opportunity to overcome his difficulty. After remedial work he tries Form 2 of the check.

Criterion scores recommended for Form 2 checks are about 90% and there is a "Teacher's Judgment" safety valve to let students proceed or do further remedial work in borderline cases.

Instructors must stress to students that evaluation is for diagnostic and remedial purposes and not for the usual percentage mark to place them on a scale with other students to see if they pass or fail. Gradually both the instructor and the student should come to treat evaluation as a source of learning more about the student himself, his strengths and weaknesses, and the methods and materials best suited for his learning needs.

The cycle of testing, individual prescription, individual work with varying materials and methods, and individual evaluation continues throughout the program.

B - THE INSTRUCTOR IN THE CLASSROOM

Training instructors for the LINC program includes introducing them to a new role in the classroom. This role differs greatly from that of the teacher in the traditional classroom. The LINC process itself, as a vehicle for new approaches and a new role for instructors, does, if they follow it conscientiously, force them to change their ways, but they can change more effectively when they are made conscious of the contrast between the role of instructor as a planner of lessons, class lecturer and fountain of all knowledge, and the role of diagnostician, prescription specialist, personal instructor and counsellor, and the classroom manager of systems and materials.

The LINC program releases an instructor from preparing daily lessons to spend more time with students who need his help. He can call on students to do peer teaching when he cannot keep up to all the personal demands for assistance. There is no better way for a student to reinforce or consolidate what he has just learned than to teach it to another. There can be more than the recommended 15 adults in a LINC classroom if the instructor can organize efficient peer teaching.

An instructor has to learn to promote a changed physical and social environment in the classroom. There must be classroom rules, but the students themselves ought to participate in making them and in disciplining themselves. They may want to be free to move around the classroom, to change the furniture, to sit and work in small groups or individually, to break up the straight rows, to help others and get help

as they require, to smoke or to drink coffee while working. One of the most difficult social changes to make in the classroom is to drag the teacher out from behind his desk, to stop him from using it as a protective shield between himself and his students. The successful teacher of adults has to work from within the group and not from outside it.

An anecdote about a new LINC classroom in one of the eastern provinces describes an important visitor. He could not distinguish the instructor from the students, he was puzzled to find a student working permanently at the teacher's desk over against the wall, and he was somewhat chagrined that everybody kept on working and paid little attention to him. His comment was that he had never visited a classroom like that before.

Adults often enter upgrading or retraining programs with built-in insecurity and fears: fear of failing again, fear of being laughed at or made to feel foolish, fear that all the other students will do well but that they won't measure up, fear of an imposing building and of an educational system not really meant for them, and fear of a well-educated instructor who is far above them. The fears may be irrational, but they are nevertheless present, and they must be understood.

Then there are physiological lacks, especially among the economically disadvantaged. Students may have failing eyesight or hearing and not be conscious of it; they may find it difficult to sit still in a confined space for several hours or even to hold a pencil. They may suffer from poor health or malnutrition because of unwise eating habits, or from insufficient sleep because of an irregular life style. Excessive use of alcohol or drugs may have impaired their intellectual acuity.

Instructors must learn to consider the sociological factors, too, the whole culture of the undereducated in relation to unemployment, under-employment and welfare. Their adult students may find it difficult to communicate. They may resent impersonal treatment, and they will certainly not want to be treated as children. Anxieties about family, financial matters, health, and jobs may nag them continually, making it difficult for them to concentrate on the facts and figures in their lessons.

On the other hand, instructors need to learn to take advantage of the positive strengths that adults have, their wide ranging experiences, knowledge of life, ability to use reason, and their strong motivation to succeed when they realize the value of a goal and their own capability to achieve it.

With understanding, the instructor can lead a student on to face his own mistakes and to do something about them, to make him realize that he is not doing work for the teacher but for himself. These are steps leading to responsibility for his own self-concept. In a program geared for his skill level, in which he is carefully placed and given work that he can do, he may begin to feel academically successful for the first time in his life. The effect will give him more self-respect. He will come to believe that he is capable of learning, and that he can move up a career ladder if he improves his academic level. A feature of the LINC program in use is that many students, realizing success in learning, develop more ambition and higher expectations. Adult basic education gives them more than a certificate or entry into further training; it gives them self-confidence and a better control of their own lives.

Both professionals and para-professionals can become excellent instructors for adults. Each has his own strengths. The para-professional may be more successful immediately in establishing a good working relationship with students; students may fear him less and be more willing to ask his help or to confide their problems to him as one who "understands their language". On the other hand, a professional teacher is generally better able to diagnose learning difficulties and to prepare his own remedial work sheets to help students overcome particular difficulties. If on top of his pedagogical skills he can also establish a sympathetic relationship with his students, the professional instructor can maintain his place as the best person for the job.

C - LOCALIZING THE LINC PROGRAM

Part of the training of instructors must be to help them to adapt the program to meet the standards and curriculum requirements of their own institution or province.

Adaptation may be as simple as changing place names in word problems and exercises in order to give a local flavour to the content. At a slightly higher level instructors may want to add a few more objectives or items, or even to create a completely new unit. They can adapt the program gradually, starting with a full program on Day 1 of any training period and modifying it as times goes by or as needed change becomes apparent. In some cases instructors and curriculum development teams may plan to rewrite a complete course, using the LINC system as a foundation on which to build their new content. For them the LINC program becomes

a model and a source of objectives and questions to borrow from. Some institutions have patterned other courses, such as science and commercial subjects, on the LINC system.

As part of their training, instructors are taught a model of curriculum development which follows six basic steps or phases. They can then use whatever they need from the model to localize the program.

Phase 1: Define the terminal behaviors.
Phase 2: Design an evaluation system.
Phase 3: Define and cluster instructional objectives.
Phase 4: Prepare evaluation instruments.
Phase 5: Prepare learning activities.
Phase 6: Prepare individual student activities.

D - CONCLUSION

The LINC program exemplifies the principles and processes of individualization which many adult upgrading institutions in Canada are trying to implement. Use of the program encourages, and even forces, instructors to work at a one-to-one level with adult students. If instructors use the program conscientiously, even after they expand or adapt it, they automatically put the principles and processes into effect in the classroom. In this way the LINC program is a vehicle for innovation.

LINC was designed as a core program with syncretic capabilities; it can absorb the best features of any program or materials already in use in a school. Its built-in system of placement, diagnosis, prescription, individual work with a variety of materials and methods, and evaluation provides a framework for varying content and standards needed to fit a local situation.

Busy instructors may not have the time, ability, or inclination to develop a full program at once. However, by giving them a framework, a basic system complete and viable from the first day, they are relieved of much of the tedium of development, they have a model to follow, they can make changes and improvements gradually and they can be expected to conduct a very high level of relevant training in their classrooms.

The new LINC program now under development will encompass the mathematics, communications and reasoning skills required in jobs as identified in the generic skills project.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

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APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 1 - WHOLE NUMBERS

ITEM A - UNIT 1

READ, WRITE, AND COUNT (WHOLE NUMBERS)

OBJECTIVES

1. Count a set of up to 100 objects and state or write the number of objects counted.

2. Identify place value of digits in a given whole number with up to 7 digits.

3. Read a given whole number less than 10 million and write its name in words.

4. Write a whole number less than 10 million given the word name of the number.

5. Write numbers to one million after counting or reading the word name of the number.

6. Arrange a set of whole numbers in ascending or descending order.

ITEM B - UNIT 1

ADD AND SUBTRACT (WHOLE NUMBERS)

OBJECTIVES

1. Perform additions of whole numbers given instructions such as:

   What is the total of 8 and 5?
   Find the sum of 8 and 5.
   Add 8 and 5.
   8 plus 5 is ___.
   8 + 5 = ___.

   $$\begin{array}{r} 8 \\ +5 \\ \hline \end{array}$$

2. Find the sum of a set of whole numbers of 1-5 digits including cases where carrying is required.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

3. Perform subtraction of whole numbers given instructions such as:

   8 minus 5 is ___.
   Subtract 5 from 8.
   Find the difference of 8 and 5.
   If you had 8 and gave away 5, you would have ___.
   8 - 5 = ___.
    8
   -5

4. Find the difference of two 1-5 digit numbers including cases where borrowing is required.

5. Solve a routine word problem using subtraction or addition of whole numbers.

ITEM C - UNIT 1

MULTIPLY (WHOLE NUMBERS)

OBJECTIVES

1. Perform multiplication of whole numbers given instructions such as:

   6 times 2 is ___.
   Three two's are ___.
   The product of 6 and 2 is ___.
   6 x 2 = ___.
    6
   x2

2. Find the product of a given pair of whole numbers of which one number is up to 5 digits and the other number up to three digits.

3. Solve a routine word problem using multiplication or division of whole numbers.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM D - UNIT 1

DIVIDE (WHOLE NUMBERS)

OBJECTIVES

1. Perform division of two simple whole numbers (no remainder) given instructions such as:

   2 divided by 6 is ___.
   2 into 6 goes ___ times.
   The quotient of 6 divided by 2 is ___.
   $6 \div 2 =$ ___.
   $2\overline{)6} =$ ___.
   $\frac{6}{2} =$ ___.

2. Find quotients of 1-5 digit dividends and 1-3 divisors including cases where there are remainders.

3. Solve routine word problems using division of whole numbers.

ITEM E - UNIT 1

WORD PROBLEMS (WHOLE NUMBERS)

OBJECTIVE

1. Use addition, subtraction, multiplication or division, as appropriate, in the solution of routine occupational word problems with whole numbers.

ITEM F - UNIT 1

ROUND OFF (WHOLE NUMBERS)

OBJECTIVE

1. Round off a number to nearest ten, hundred, thousand, ten thousand, or hundred thousand.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 2 - FRACTIONS

NB: Fractions used for test items are to be those which could realistically be expected to be used in occupational work (e.g., one to two digit denominators OR even hundreds, thousands). Fractions used in occupational operations generally have denominators such as 2,3,4,5,10,25,100,1000,2000 and not 7,9,37,1005, etc. Comparison or reduction of fractions usually involves no more than three fractions and the denominators usually have a measurement relationship such as x/4, x/8, x/16, or x/9 and x/27.

ITEM A - UNIT 2

READ AND WRITE (FRACTIONS)

OBJECTIVES

1. Identify a common fraction as being a number of parts of a total number of equal parts.
2. Reduce a fraction to its simplest form (lowest terms).
3. Change improper fractions to mixed numbers and mixed numbers to improper fractions.
4. Write equivalent fractions for a given fraction given a new numerator and denominator.
5. Arrange a set of fractions and/or mixed numbers in ascending or descending order.
6. Write what fractional part one number is of another in simplest form.

ITEM B - UNIT 2

ADD AND SUBTRACT (FRACTIONS)

OBJECTIVES

1. Calculate the sum in simplest form of two or three common fractions with like denominators.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

2. Calculate the sum in simplest form of two or three common fractions with unlike denominators.

3. Calculate the sum in simplest form of two or three mixed numbers with like and unlike denominators.

4. Calculate the sum in simplest form of two or three numbers which include at least one proper fraction and one mixed number.

5. Calculate the difference in simplest form of two common fractions with like denominators.

6. Calculate the difference in simplest form of two common fractions with unlike denominators.

7. Calculate the difference in simplest form of two mixed numbers which have like denominators including cases where borrowing is required.

8. Calculate the difference in simplest form of two mixed numbers which have unlike denominators including cases where borrowing is required.

9. Solve a routine word problem using addition and/or subtraction of fractional numbers.

ITEM C - UNIT 2

MULTIPLY (FRACTIONS)

OBJECTIVES

1. Calculate the product in simplest form of:
   a. a common fraction and a whole number
   b. two common fractions.

2. Calculate the product in simplest form:
   a. a mixed number and a whole number
   b. two mixed numbers.

3. Calculate the product in simplest form of two or three numbers which include at least one common fraction and one mixed number.

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INSTRUCTIONAL OBJECTIVES

4. Solve a routine word problem using multiplication of fractional numbers.

ITEM D - UNIT 2

DIVIDE (FRACTIONS)

OBJECTIVES

1. Calculate the quotient in simplest form of:
   a. a common fraction divided by a whole number
   b. two common fractions
   c. a whole number divided by a common fraction.

2. Calculate the quotient in simplest form of:
   a. a mixed number and a whole number
   b. a mixed number and a common number
   c. two mixed numbers.

3. Solve a routine word problem using division of fractional numbers.

ITEM E - UNIT 2

WORD PROBLEMS (FRACTIONS)

OBJECTIVES

1. Solve a routine word problem using addition, subtraction, multiplication and/or division of fractions.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 3 - DECIMALS

NB: Decimals used for test items are to be those which could realistically be expected to be used in occupational work (e.g., no more than three zeros required to position the decimal (.0001) or no more than three digits after the decimal is rounded off (1.782)

ITEM A - UNIT 3

READ AND WRITE (DECIMALS)

OBJECTIVES

1. Read a given 1-4 place decimal fraction and write its name in words.
2. Write a 1-4 place decimal fraction given the word name of the number.
3. Arrange a set of decimal fractions in ascending or descending order.
4. Write:
   a. the total value of a given combination of dollars, quarters, dimes, nickels, and cents.
   b. the combination of dollars and coins equivalent to a given money value.

ITEM B - UNIT 3

ADD AND SUBTRACT (DECIMALS)

OBJECTIVES

1. Calculate the sum of a set of decimal fractions.
2. Calculate the difference of two decimal fractions.
3. Solve a routine word problem using addition and/or subtraction of decimal fractions.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM C - UNIT 3

MULTIPLY AND DIVIDE (DECIMALS)

OBJECTIVES

1. Calculate the product of two decimal fractions when rounding off is (a) not required (b) required.

2. Calculate to a given number of decimal places, the quotient of a whole number divided into:
   a. a whole number larger than the divisor.
   b. a whole number smaller than the divisor.
   c. a decimal fraction.

3. Calculate to a given number of decimal places, the quotient of a decimal fraction divided into:
   a. a decimal fraction.
   b. a whole number.

4. Solve a routine word problem using multiplication and/or division of decimals.

ITEM D - UNIT 3

WORD PROBLEMS (DECIMALS)

OBJECTIVE

1. Solve a routine word problem using addition, subtraction, multiplication, and/or division of decimal fractions and common fractions or mixed numbers.

ITEM E - UNIT 3

ROUND OFF (DECIMALS)

OBJECTIVES

1. Round off a decimal fraction to the nearest tenth, hundredth, thousandth, or ten-thousandth.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 4 - PERCENT

ITEM A - UNIT 4

READ AND WRITE (PERCENT)

OBJECTIVES

1. Identify a percent as equivalent to a fraction with 100 as the denominator.

2. Identify the % symbol by writing in words a given percentage.

ITEM B - UNIT 4

CALCULATE (PERCENT)

OBJECTIVES

1. Calculate a percent of a number. (Type 1: a% of b = ___.)

2. Solve a routine word problem involving calculation of a percent of a number.

3. Calculate the percent one number is of another. (Type 2: a is ___% of b).

4. Solve a routine word problem involving calculation of the percent one number is of another.

5. Calculate a number when a percent of it is known. (Type 3: a% of ___ = b).

6. Solve a routine word problem involving calculation of a number when a percent of it is known.

7. Solve percentage word problems involving money, people, objects, time, and other data.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM C - UNIT 4

RATIO (PERCENT)

OBJECTIVES

1. Identify comparisons of two numbers in the forms a:b, $\frac{a}{b}$, "a is to b", or "a parts to b parts", etc., as ratios.

2. State or write in simplest form (lowest terms) a ratio of two numbers in the form:
   a. a:b
   b. $\frac{a}{b}$

3. Write a ratio given a description of the two numbers one of which must be determined by adding or subtracting the numbers in a given ratio.

ITEM D - UNIT 4

PROPORTION (PERCENT)

OBJECTIVES

1. Identify an equality of two numbers in the form: a:b - c:d, $\frac{a}{b} = \frac{c}{d}$, "a is to b as c is to d", or "a parts to b parts is the same as c parts to d parts", etc., as a proportion.

2. Calculate the unknown number given 3 numbers in a proportion.

3. Calculate a number when a fraction of it is known, using the proportion method.

4. Solve a routine word problem which involves either a ratio or a rate, using the proportion method.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM E - UNIT 4

WORD PROBLEMS (PERCENT)

OBJECTIVE

1. Solve a routine word problem which involves the use of percentage calculations, ratio or proportion.

UNIT 5 - MIXED OPERATIONS

ITEM A - UNIT 5

EQUIVALENTS (MIXED OPERATIONS)

OBJECTIVES

1. Convert:
   a. a common fraction or mixed number to a decimal fraction.
   b. a decimal fraction to a common fraction or mixed number.

2. Convert:
   a. a percent to a fraction.
   b. a fraction to a percent.

3. Convert:
   a. a percent to a decimal.
   b. a decimal to a percent.

4. Use standard tables to convert:
   a. a fraction to a percent.
   b. a percent to a fraction.

ITEM B - UNIT 5

ORDER OF OPERATIONS (MIXED OPERATIONS)

OBJECTIVES

1. Simplify an expression involving addition and subtraction of whole numbers or fractions.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 6 - ESTIMATE MEASURES

NB: The ability to estimate measurements is rarely included in academic programs. A high proportion of the occupations surveyed indicated that this is a requirement. It is also to be noted that many who require this skill do not also have to have the skill of actually measuring. The following criteria are appropriate to this item:

(1) Excessively small or large measurement estimates are not required. Extremes such as seconds - months, less than an ounce - over 100 lbs., less than a quarter inch - over 50 ft., less than one fluid ounce - over 10 gallons, should be avoided.

(2) Objects used should have a regular configuration of a circular, square or rectangular type.

(3) Students should be able to use various sensory organs, feel, see, handle, etc. It would not be realistic, for example, to ask a student to judge the weight of a sealed container without being able to lift it. Cognitive knowledge of the composition of various materials is not a requirement, e.g., hardwood is normally heavier than softwood.

(4) Few workers require all of the items in this unit and each item should therefore be treated independently of the other items.

ITEM A - UNIT 6

TIME (ESTIMATE MEASURES)

OBJECTIVES

1. Identify seconds, minutes, hours, days, weeks, months and years as units of time.

2. Convert units of time to other units (e.g., 90 minutes is 1 1/2 hours).

3. Be able to estimate the duration of time actually required to perform routine functions, within 50% of the actual time.

   NB: The routine functions selected should not be for excessively short or long durations.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM B - UNIT 6

WEIGHT (ESTIMATE MEASURES)

OBJECTIVES

1. Identify ounces, pounds and tons as units of weight measure.
2. Convert units of weight to other units (e.g., 32 ounces is 2 pounds).
3. Be able to estimate the weights of common objects within 20% of the actual weight.

   NB: The common objects should be items which the student could be expected to apply judgement by handling and not be excessively light or heavy.

ITEM C - UNIT 6

DISTANCE (ESTIMATE MEASURES)

OBJECTIVES

1. Identify inches, feet, yards and miles as units of distance.
2. Convert units of distance to other units (e.g., 18 inches = 1 1/2 feet).
3. Be able to estimate the length, width or height of common objects or the distance between objects, within 20% of the actual distance.

   NB: The objects or distance between objects should not be excessively short or lengthy distances but should be distances over which the student could be expected to apply judgement by visual inspection.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM D - UNIT 6

AREA (ESTIMATE MEASURES)

OBJECTIVES

1. Identify square inches, square feet, square yards as the measure of the surface of a figure.

2. Convert units of area to other units (e.g., 144 square inches equals one square foot).

3. Be able to estimate the area of common objects within 50% plus or minus of the actual area.

   NB: The common objects should be rectangular or square and not be excessively small or large.

ITEM E - UNIT 6

LIQUID VOLUME (ESTIMATE MEASURES)

OBJECTIVES

1. Identify fluid ounces, pints, quarts and gallons as units of liquid capacity.

2. Convert units of liquid measure to other units (e.g., 1 1/2 gallons equals 6 quarts).

3. Be able to estimate the liquid contents or the capacity of common containers, within 50% plus or minus of the actual content or capacity.

   NB: The common containers to be regular shaped bottles, tins, etc., of a circular, square or rectangular configuration without irregular constrictions except for the neck and not be excessively large or small.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM F - UNIT 6

SPATIAL VOLUME (ESTIMATE MEASURES)

OBJECTIVES

1. Identify cubic inches, cubic feet, and cubic yards as units of space measurement.
2. Convert units of space measurement to other units (e.g., 27 cubic feet equals one cubic yard).
3. Be able to estimate the cubic measurement of a common object or space, within 50% plus or minus of the actual size.

   NB: The common object or space to be a reasonable size (small as a book to as large as a classroom) and to be square or rectangular in configuration.

UNIT 7 - MEASURE

ITEM A - UNIT 7

SCALES (MEASURE)

OBJECTIVE

1. Visually read common scales, such as thermometers, weigh scales, clocks, water meters, gas meters, tape measures, pressure scales and odometers.

ITEM B - UNIT 7

TIME (MEASURE)

OBJECTIVES

1. Add and subtract 12-hour clock times including cases in subtraction where borrowing is required.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

2. Be able to measure the actual duration of time expended to perform routine functions, correct within 5% of actual duration.

ITEM C - UNIT 7

WEIGHT (MEASURE)

OBJECTIVES

1. Add and subtract weight measures including cases where borrowing is required.

2. Be able to weigh common objects on balance or spring loaded scales, correct within one unit of the scale readings.

ITEM D - UNIT 7

DISTANCE (MEASURE)

OBJECTIVES

1. Add and subtract units of distance including cases where borrowing is required.

2. Measure a given distance or one dimension of an object with a ruler or tape measure to the nearest 1/8 inch.

ITEM E - UNIT 7

QUANTITY (MEASURE)

OBJECTIVES

1. Add and subtract units of liquid measure including cases where re-grouping is required.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

2. Be able to measure liquid content or capacity of a container to within 1 unit of the scale on the measuring instrument.

ITEM F - UNIT 7

VERNIERS (MEASURE)

OBJECTIVE

1. Usually read, from pictorial representations of common verniers, the indicated measurement to the nearest unit.

UNIT 8 - METRIC MEASUREMENT

ITEM A - UNIT 8

WEIGHT (METRIC MEASUREMENT)

OBJECTIVES

1. Identify milligrams, centigrams, decigrams, grams, decagrams, hectograms, kilograms and metric tons as units of metric weight measure.

2. Convert units of weight from one metric unit to another (e.g., 100 grams equals one hectogram).

3. Be able to estimate the weight of common objects within 20% plus or minus of the actual metric weight.

4. Be able to weigh common objects on balance or spring loaded scales, correct within one unit of the metric scale readings.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM B - UNIT 8

DISTANCE (METRIC MEASUREMENT)

OBJECTIVES

1. Identify millimeters, centimeters, decimeters, meters, decameter, hectometers and kilometers as units of metric distance measure.

2. Convert units of distance from one metric unit to another (e.g. one hectometer equals 100 meters).

3. Be able to estimate the length, width or height of common objects or the distance between objects, within 20% plus or minus of the actual distance.

4. Be able to measure a given distance or one dimension object with a ruler or tape measure to the nearest centimeter.

ITEM C - UNIT 8

QUANTITY (METRIC MEASUREMENT)

OBJECTIVES

1. Identify milliliter, centiliter, deciliter, liter, decaliter and hectoliter as units of metric capacity.

2. Convert units of capacity from one metric unit to another (e.g., 10 liters equals one decaliter).

3. Be able to estimate in metric units the contents or the capacity of common containers, within 20% plus or minus of the actual content or capacity.

4. Be able to measure content or capacity of a container to within 1 unit of the scale of the measuring instrument.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM D - UNIT 8

WEIGHT CONVERSION (METRIC MEASUREMENT)

OBJECTIVES

1. Given tables, be able to convert metric weight measurements to English measurements.

2. Given tables, be able to convert English weight measurements to metric measurements.

ITEM E - UNIT 8

DISTANCE CONVERSION (METRIC MEASUREMENTS)

OBJECTIVES

1. Given tables, be able to convert metric distance measurements to English measurements.

2. Given tables, be able to convert English distance measurements to metric measurements.

ITEM F - UNIT 8

QUANTITY CONVERSION (METRIC MEASUREMENT)

OBJECTIVES

1. Given tables, be able to convert metric measures of capacity to English measurements.

2. Given tables, be able to convert English quantities to metric measurements.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 9 - DIMENSIONS

ITEM A - UNIT 9

FIGURES AND FORMS (DIMENSIONS)

OBJECTIVES

1. Identify rectangles, squares, triangles, circles, rectangular solids, cubes, pyramids, cones, cylinders and spheres from a set of objects, pictures of objects, or names of objects.

2. Identify:
   a. rectangles, squares, triangles, and circles as plane figures (two-dimensional).
   b. rectangular solids, cubes, pyramids, cones, cylinders, and spheres as solid figures (three-dimensional).

3. Identify rectangles, squares, triangles, circles, rectangular solids, cubes, and cylinders given their definitions or characteristics.

ITEM B - UNIT 9

DRAW/SKETCH (DIMENSIONS)

OBJECTIVES

1. Draw or sketch (not to scale) (student choice) squares, rectangles, triangles, circles, cubes, rectangular solids, cylinders, cones and pyramids.

2. Represent, by drawing or sketching (student choice), common objects using oblique projections.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM C - UNIT 9

READ SCALE DRAWINGS (DIMENSIONS)

OBJECTIVES

1. Identify 1:4, 6:1, 1" to the foot, 1" = 5 mi., 1:50,000, etc., as examples of scales used to represent reductions or expansions of the actual size of an object.
2. Convert a scale measurement to true size given the scale.
3. Identify a given drawing as a map, blue print, photograph, schematic diagram or assembly (exploded view) drawing.
4. Trace a particular subsystem on a single schematic drawing.
5. Identify the order in which parts are put together in an assembly drawing.

ITEM D - UNIT 9

MEASURE SCALE DRAWINGS (MEASUREMENTS)

OBJECTIVE

1. Calculate actual dimensions of an object given a ruler and a simple scale drawing of the object.

ITEM E - UNIT 9

DRAW TO SCALE (MEASUREMENTS)

OBJECTIVE

1. Given a compass, right angle triangle and a ruler be able to draw to scale front, top and side representations of common objects which are rectangular solids, cylinders, cones or pyramids.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

NB: For items B to E, emphasis should not be placed on drafting skills (line weight, corner construction, etc.) or on artistic skills (shading, balance, etc.) but on accuracy of reading, measurements to and from, etc. In other words, can the student properly read the drawings and construct sketches or drawings which can be accurately read?

UNIT 10 - DIMENSIONS

ITEM A - UNIT 10

PERIMETER (DIMENSIONS)

OBJECTIVES

1. Identify perimeter as the length of the outer boundary of a plane figure and identify the units used as inches, feet, yards, etc.

2. Calculate the perimeter of a given rectangle or square.

3. Measure the perimeter of a given figure by successive ruler measurements. Identify π as a constant equal to c/d for all circles and identify its approximate value as 3 1/7 or 3.14.

4. Calculate the circumference of a circle given:
   a. its radius
   b. its diameter

5. Solve a routine word problem involving perimeter.

ITEM B - UNIT 10

AREA (DIMENSIONS)

OBJECTIVES

1. Identify area as the measurement of the surface of a figure and state units used. (sq. in., sq. ft., sq. yd., sq. mi.)

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

2. Calculate the area of a given square.

3. Calculate the area of a given rectangle.

4. Calculate the area of a given triangle.

5. Calculate the area of a given circle.

6. Solve practical problems involving area calculations of squares, rectangles, triangles, and circles.

ITEM C - UNIT 10

VOLUME (DIMENSIONS)

OBJECTIVES

1. Calculate the volume of a given rectangular solid (including cubes).

2. Calculate the volume of a given cylinder.

3. Solve practical problems involving volume calculations of rectangular solids and cylinders.

ITEM D - UNIT 10

READ GRAPHS (DIMENSIONS)

OBJECTIVE

1. Read specified data from simple line, bar and circle graphs.

ITEM F - UNIT 10

CONSTRUCT GRAPHS (DIMENSIONS)

OBJECTIVE

1. Given simple data construct line, and bar graphs to display a visual representation of the data.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 11 - ALGEBRA

ITEM A - UNIT 11

ONE VARIABLE (ALGEBRA)

OBJECTIVES

1. Write single variable open sentences given verbal statements of relations.
2. Solve single variable open sentences.
3. Solve routine word problems which require equations in one unknown.

ITEM B - UNIT 11

TWO VARIABLES (ALGEBRA)

OBJECTIVES

1. Write two variable open sentences given verbal statements of relations.
2. Solve two variable open sentences.
3. Solve routine word problems which require equations in two unknowns.

ITEM C - UNIT 11

QUADRATICS (ALGEBRA)

OBJECTIVES

Not established.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM D - UNIT 11

VARIATIONS (ALGEBRA)

OBJECTIVES

Not established.

UNIT 12 - TRIGONOMETRY

ITEM A - UNIT 12

LOGARITHMS (TRIGONOMETRY)

OBJECTIVES

1. Solve multiplication problems by using logarithm tables.
2. Solve division problems by using logarithm tables.

ITEM B - UNIT 12

SLIDE RULE (TRIGONOMETRY)

OBJECTIVES

1. Solve multiplication problems by using a slide rule.
2. Solve division problems by using a slide rule.
3. Solve exponent and root problems by using a slide rule.

ITEM C - UNIT 12

CALCULATION (TRIGONOMETRY)

OBJECTIVES

Not established.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 13 - LISTEN

NB: The audio tapes should contain a variety of simulated occupational listening conditions.

ITEM A - UNIT 13

LITERAL COMPREHENSION (LISTEN)

OBJECTIVES

1. Listen to an audio tape and be able to answer "what", "who", "where", and "when" questions.

2. Listen to an audio tape and be able to identify the order or sequence of required activities.

3. Listen to an audio tape and be able to identify the latitude allowed by the speaker.

4. Listen to an audio tape and be able to perform a series of activities that requires recall of instructions or information.

   NB: The students to be encouraged to take notes during the playback and to be aware of the objectives (but not the actual test items). This item is intended to develop the skills of effectively listening for the factual aspects of oral communication.

ITEM B - UNIT 13

INTERPRETIVE COMPREHENSION (LISTEN)

OBJECTIVES

1. Listen to an audio tape and be able to identify the main purpose of the talk.

2. Listen to an audio tape and be able to answer "how" and "why" questions.

3. Listen to an audio tape and be able to answer questions which require a generalized interpretation of the talk.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM C - UNIT 13

EVALUATIVE COMPREHENSION (LISTEN)

OBJECTIVES

1. Listen to an audio tape and be able to identify speakers' statements as being facts or opinions.

2. Listen to an audio tape and be able to perform a series of activities that requires recall of instructions or information AND interpretive and evaluative comprehension.

   NB: Items B and C: operant as well as respondent behavior are important in these two items. It should not be expected that students achieve conformity of conclusions, rather it should be expected that they be able to defend or support their interpretive and evaluative comprehension.

UNIT 14 - TALK

ITEM A - UNIT 14

DIRECTIONS/INSTRUCTIONS (TALK)

OBJECTIVES

1. Organize and express directions in a logical sequence and with time limitations, given direction content.

2. Answer questions orally which require interpretation of an experience.

ITEM B - UNIT 14

INFORMATION (TALK)

OBJECTIVES

1. Repeat information which has been told.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

2. State the correct answer to questions on a subject about which information has been given.

3. Describe orally, in a few short sentences, a given person, place, thing, or job performed.

4. Answer questions orally about material read (such as a note, memo or letter).

5. Describe an experience or some event that was witnessed (or read about).

6. Explain to someone else how to perform a fairly complex task, given experience at performing the task, or having learned from another person or a manual how to perform the task.

ITEM C - UNIT 14

QUESTIONS (TALK)

OBJECTIVE

1. Given a short statement of a typical and realistic occupational problem and a coach or peer who has a list of facts pertinent to the problem each student will be able to obtain at least 51% of the facts by asking information seeking questions.

   NB: Items A and B are intended to develop skills of imparting information and instructions. The exercises and tests should be carefully designed to ensure that memory or understanding is not being tested. In item C the ability to obtain facts or opinions by questioning, rather than the ability to frame "proper" questions, is the essential skill.

ITEM D - UNIT 14

FORMAL TALKS (TALK)

OBJECTIVE

Not established.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 15 - READ

NB: Memory is not involved in these objectives. The written material (up to Grade level 8.5 Fry Readability Scale) supplied to the student should be available to the student during performance.

ITEM A - UNIT 15

LITERAL COMPREHENSION (READ)

OBJECTIVES

1. Identify statements as being true or false after reading a given selection.

2. Answer "what", "who", "where", and "when" questions using factual information from a given selection.

3. Given a set of instructions involving activities to be performed by a number of people, and the particular role, prepare a list and sequence of activities to be performed.

ITEM B - UNIT 15

INTERPRETIVE AND EVALUATIVE COMPREHENSION (READ)

OBJECTIVES

1. Answer "why" and "how" questions using factual information from a given selection.

2. Answer questions which require a generalized interpretation which can be inferred from facts in a given selection.

3. Identify causes and effects from a given selection.

4. Identify and support a conclusion that can be inferred from a set of facts or from a given selection.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

5. Identify and support a prediction based on information given in a selection.

6. Separate facts and opinions in a given selection.

7. Given a set of instructions involving literal, interpretative and evaluative comprehension, and a statement of the current situation, prepare a list and sequence of activities to be performed.

ITEM C - UNIT 15

COMPARATIVE EVALUATION #1 (READ)

OBJECTIVE

1. Compare two or more written directions and identify discrepancies.

ITEM D - UNIT 15

BOOKS (READ)

OBJECTIVES

1. Be able to locate a telephone number, address or business firm from a telephone directory.

2. Be able to locate an item and its cost and catalogue number from a catalogue.

3. Be able to obtain the correct spelling for a word from a dictionary.

4. Be able to locate a particular reference in a reference book or company manual.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM E - UNIT 15

COMPARATIVE EVALUATION #2 (READ)

OBJECTIVE

1. Be able to locate similar information from two or more catalogues, books or manuals and determine which one is most suitable based on given criteria such as price, delivery date, color, size, etc.

ITEM F - UNIT 15

COMPARATIVE EVALUATION #3

OBJECTIVE

1. Be able to locate similar information from two or more books, catalogues or manuals, set criteria and determine which one is the most suitable on the criteria established.

UNIT 16 - BUSINESS READ

ITEM A - UNIT 16

NOTES, LETTERS OR MEMOS (BUSINESS READ)

OBJECTIVE

1. Given notes, letters or memos, be able to identify:

   a. the author
   b. the recipient
   c. the activities required of the recipient

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM B - UNIT 16

FORMS (BUSINESS READ)

OBJECTIVE

1. Given a variety of common business forms such as work orders, job orders, issue and receipt vouchers, claims and purchase orders, be able to answer factual questions based on the data on the forms.

ITEM C - UNIT 16

CHARTS (BUSINESS READ)

OBJECTIVE

1. Given common reference tables and charts such as organization charts, parts charts, reference tables, including charts and tables designed in matrix form (rows and columns), be able to answer factual questions based on the data supplied.

ITEM D - UNIT 16

MANUALS (BUSINESS READ)

OBJECTIVE

1. Given a typical company manual or union agreement containing administrative, policy, personnel and financial rules and regulations, be able to answer factual questions based on the manual for items such as hours of work, rates of pay, vacation or other leave, grievances, promotion and discipline.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 17 - WRITE

ITEM A - UNIT 17

PHRASES (WRITE)

OBJECTIVE

1. Given simple data in the form of words and figures the student will be able to write phrases which are legible and which convey the desired information.

ITEM B - UNIT 17

SENTENCES (WRITE)

OBJECTIVE

1. Given simple data in the form of words and figures the student will be able to write complete sentences.

   NB: The data obtained indicates that some occupations only write by filling in phrases and sentences on forms. Therefore, the only criteria for items A and B is whether or not the phrase or sentence would be understood. Correct use of capital letters, punctuation, spelling, tense, etc., although desirable is not critical at this level of performance.

ITEM C - UNIT 17

PARAGRAPHS (WRITE)

OBJECTIVES

1. Given simple data in the form of words and figures the student will be able to write sentences using capital letters, punctuation, modifiers and spelling correctly.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

2. Write a short article or report of four or five paragraphs using proper sentence structure, word usage, punctuation, and paragraph form, on a topic of interest.

ITEM D - UNIT 17

FORMS (WRITE)

OBJECTIVES

1. Given typical employment application forms the student will be able to complete them correctly, neatly and legibly.

2. Given typical business forms such as work orders, job orders, issue and receipt vouchers, claims, and purchase orders and the necessary data in words and figures, the student will be able to correctly complete or fill in the appropriate portions of the forms.

ITEM E - UNIT 17

MEMOS (WRITE)

OBJECTIVES

1. The student will be able to set up the parts of a business memo in proper form, sender's name and/or appointment, data, addressee's name and/or appointment, subject heading, body and signature.

2. Compose business memos in proper form using good sentence and paragraph structure and proper punctuation, from information supplied.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM F - UNIT 17

LETTERS (WRITE)

OBJECTIVES

1. The student will be able to set up the parts of a business letter in proper form, (sender's address, date, addressee's address, saluation, body, complementary close and signature).

2. Given the information for a letter the student will be able to organize the body of the letter into a logical sequence, such as the following:

   a. An introduction which describes the purpose or aim of the letter (why it is being written).
   b. A background or history so the reader can understand the discussion which follows.
   c. The discussion necessary for the reader to know the current facts on the arguments presented.
   d. A closure which includes the recommendation, decision, action requested or summary.

3. Compose business letters in proper form, using good sentence and paragraph structure, logical sequences, proper punctuation and spelling, from information supplied.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 18 - WRITE REPORTS

ITEM A - UNIT 18

INFORMATION REPORTS (WRITE REPORTS)

OBJECTIVE

1. Given real or simulated occupational conditions in which the student can use a variety of his senses, the student will be able to prepare a written factual report which is correct, concise and reasonably complete.

ITEM B - UNIT 18

RECOMMENDATION REPORTS (WRITE REPORTS)

OBJECTIVES

1. Given a typical and simple type of occupational problem the student will be able to select alternative courses of action to alleviate or solve the problem.

2. Given a typical and simple type of occupational problem and a list of alternative courses of action to alleviate or solve the problem the student will be able to list advantages and disadvantages for each alternative.

3. Given real or simulated occupational problems in which the student can use a variety of his senses, the student will be able to prepare a recommendation report which includes alternatives, courses of action to alleviate or solve the problem and the advantages and disadvantages of each.

NB: The condition for items A and B could be an actual activity or a film. The students should be aware of any facts which would already be known to the recipient of the report so that he would only have to report what his supervisor needs to know. The problems selected must be of a nature where the student could be expected to apply judgement on the problem and the alternatives.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM C - UNIT 18

SORT (WRITE REPORTS)

OBJECTIVE

1. Given data or objects and a classification criteria the student will be able to sort the data/objects by the various classifications.

   NB: The data/objects and the classification criteria should require a minimum of judgement. The ability to sort rather than the ability to apply judgement is the essential criteria for this objective. The exercises and tests for this objection and for the following items should go beyond the idea of sorting for filing, such as sorting for warehousing, sorting tools and materials, sorting figures and vouchers.

ITEM D - UNIT 18

CLASSIFY (WRITE REPORTS)

OBJECTIVE

1. Given data or objects such as receipts and expenditures or pictures of a variety of objects which can be readily classified by different lists, the student will be able to set up a classification system and sort the data/objects by the various classifications.

   NB: The data/objects should be presented in a way that there is an apparent need to sort them for various reasons such as filing, warehousing, providing information. The student should be aware of "why" he has to classify them and the desired skill is "how to classify".

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM E - UNIT 18

TECHNICAL REPORTS (WRITE REPORTS)

OBJECTIVES

Not established.

UNIT 19 - EXCHANGE IDEAS

ITEM A - UNIT 19

DEBATE (EXCHANGE IDEAS)

OBJECTIVES

1. The student will be able to withold judgement while listening or reading.

2. The student will be able to clarify points not understood as a result of listening or reading.

3. The student will be able to apply judgement to material heard or read after he has understood the other's intent, and then state his reaction in oral or written form.

4. The student will be able to state his point of view in oral and written form and defend the point in subsequent communication.

NB 1: Although these objectives suggest a high degree of skill the tests and learning processes should be at an unsophisticated level. Preferably the same material (oral and written) should be used for each objective so the student will learn to systematically follow these steps.

NB 2: Interpersonal behaviors necessary to supplement these skills will be identified as part of the "people" analysis to be carried out at a later date. At that time, the higher level skills of persuading and negotiating will be examined.

NB 3: The above objectives are only intended for the one to one level of communication.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM B - UNIT 19

PEER DEBATE (EXCHANGE IDEAS)

OBJECTIVES

1. The student will be able to identify the fact that, in oral or written conversation with customers, workers' comments, points of view and ideas are accepted as company policy and that the company for which he works will probably morally and legally have to comply with any commitments which the employee makes.

2. Given case studies of conversations between customers and employees the student will be able to decide:

   a. Whether to give the customer a final decision and what the decision should be, or;

   b. Ask the supervisor to make the decision.

3. Given case studies of discussions between fellow workers the student will be able to decide:

   a. Whether to compromise, accept the viewpoints of the other, or retain his own viewpoint and then state his decision in oral or written form, or;

   b. Ask the supervisor to make the decision.

ITEM C - UNIT 19

SUPERVISOR DEBATE (EXCHANGE IDEAS)

OBJECTIVES

1. The student will be able to identify the fact that, in a debate between worker and supervisor, the worker is normally expected to seek clarification of supervisor's instructions and to make the final decision to compromise, accept or reject the employee's point of view.

2. The student will be able to perform objectives 1 to 4 of Item A, in oral form, with a person who is, or appears to be, a person of authority.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM D - UNIT 19

CONFERENCES (EXCHANGE IDEAS)

OBJECTIVES

1. In a conference situation with peers and a person of authority the student will be able to:

   a. State his point of view or supply factual information when asked.

   b. Contribute to the discussion by:
      (1) building on previous discussion; and
      (2) introducing single concepts at a time.

   c. Take notes for any future activities which are his responsibility.

   NB: Units A, B and C are intended for the one to one level of communication. In unit D the skills are those of a participant in a conference and not those of the chairman or supervisor. Business conferences rarely take the form of a "meeting" of the type that involves making motions and other parliamentary procedures.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 20 - DIAGNOSE

ITEM A - UNIT 20

LIST CAUSES (DIAGNOSE)

OBJECTIVES

1. Given a series of facts pertinent to a simple problem situation composed of statements which are either symptoms (effects of) or problems (causes of) the student will be able to correctly identify the statements as symptoms or problems.

2. Given a series of facts pertinent to a simple problem composed of statements which are either symptoms or problems, and statements which are neither, the student will be able to correctly identify the symptom and problem statements.

3. Given a series of symptom facts pertinent to a simple problem the student will be able to prepare a list of the possible problems.

ITEM B - UNIT 20

LOOK UP CAUSES (DIAGNOSE)

OBJECTIVE

1. Given a series of symptom facts pertinent to a simple problem and a chart or written material which describes common cause - effect relationships, the student will be able to prepare a list of the possible problems.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM C - UNIT 20

SET PRIORITIES (DIAGNOSE)

OBJECTIVES

1. Given a series of symptom and problem facts pertinent to a simple problem situation which has a cause - effect relationship between two or more symptoms, the student will be able to trace the symptom - problem relationship.

2. Given a list of possible symptoms and problems for a simple problem and their relationship the student will be able to establish a priority list for problem identification.

3. Given a series of symptom facts pertinent to a simple problem situation the student will be able to identify possible problems and establish a priority list for problem identification.

ITEM D - UNIT 20

LOOK UP METHODS (DIAGNOSE)

OBJECTIVE

1. Given a simple problem situation, with: the possible symptoms and problems identified; the possible symptom/problem relationship established; a list of priorities for problem identification; and an instructional manual which describes how to check for faults; the student will be able to identify the appropriate portions of the manual.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM E - UNIT 20

PROBING QUESTIONS (DIAGNOSE)

OBJECTIVES

1. Given a simple problem situation in which possible cause-effect relationships can be identified by questioning and a list of possible problems with their priorities, the student will be able to eliminate in order possible problems by asking probing questions until the problem has been identified.

2. Given a simple problem situation in which possible cause-effect relationships can be identified by questioning, the student will be able to prepare a list of the possible problems, establish a priority list and eliminate in order possible problems by asking probing questions until the problem has been identified.

ITEM F - UNIT 20

USE SENSES (DIAGNOSE)

OBJECTIVES

1. Given a simple problem situation in which possible cause-effect relationships can be identified by sensory organs (touch, see, smell, or taste) and a list of possible problems with their priorities, the student will be able to eliminate in order the possible problems by the use of his senses until the problem has been identified.

2. Given a simple problem situation in which possible cause-effect relationships can be identified by sensory organs, the student will be able to prepare a list of possible problems, establish a priority list and eliminate in order possible problems by the use of his senses until the problem has been identified.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

UNIT 21 - LATITUDE

ITEM A - UNIT 21

SIMPLE INSTRUCTIONS (LATITUDE)

OBJECTIVE

1. Given simple instructions of the nature of, "If this happens - do that", in oral or written form, the student will be able to recall and comply with the instructions, when appropriate.

ITEM B - UNIT 21

COMPLEX INSTRUCTIONS (LATITUDE)

OBJECTIVE

1. Given instructions of the nature of, "If A and B happen, do X, but if A and C happen, do Y", in oral or written form the student will be able to recall and comply with the instructions, when appropriate.

ITEM C - UNIT 21

COMPOUND INSTRUCTIONS (LATITUDE)

OBJECTIVE

1. Given a work situation and instruction of the nature of, "If A and B happen use your judgement whether to do X, Y, or Z", the student will be able to recall the instruction, decide on and take appropriate action when appropriate.

APPENDIX 5

INSTRUCTIONAL OBJECTIVES

ITEM D - UNIT 21

SET PRIORITIES (LATITUDE)

OBJECTIVE

1. Given a hypothetical working situation, a list of both routine and unique tasks to be performed, deadlines which have been established for completion of certain tasks, and estimates of time to perform each task, the student will be able to establish a work priority list.